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Canadian Computer/Communications

Report. 1972. 2 vols.

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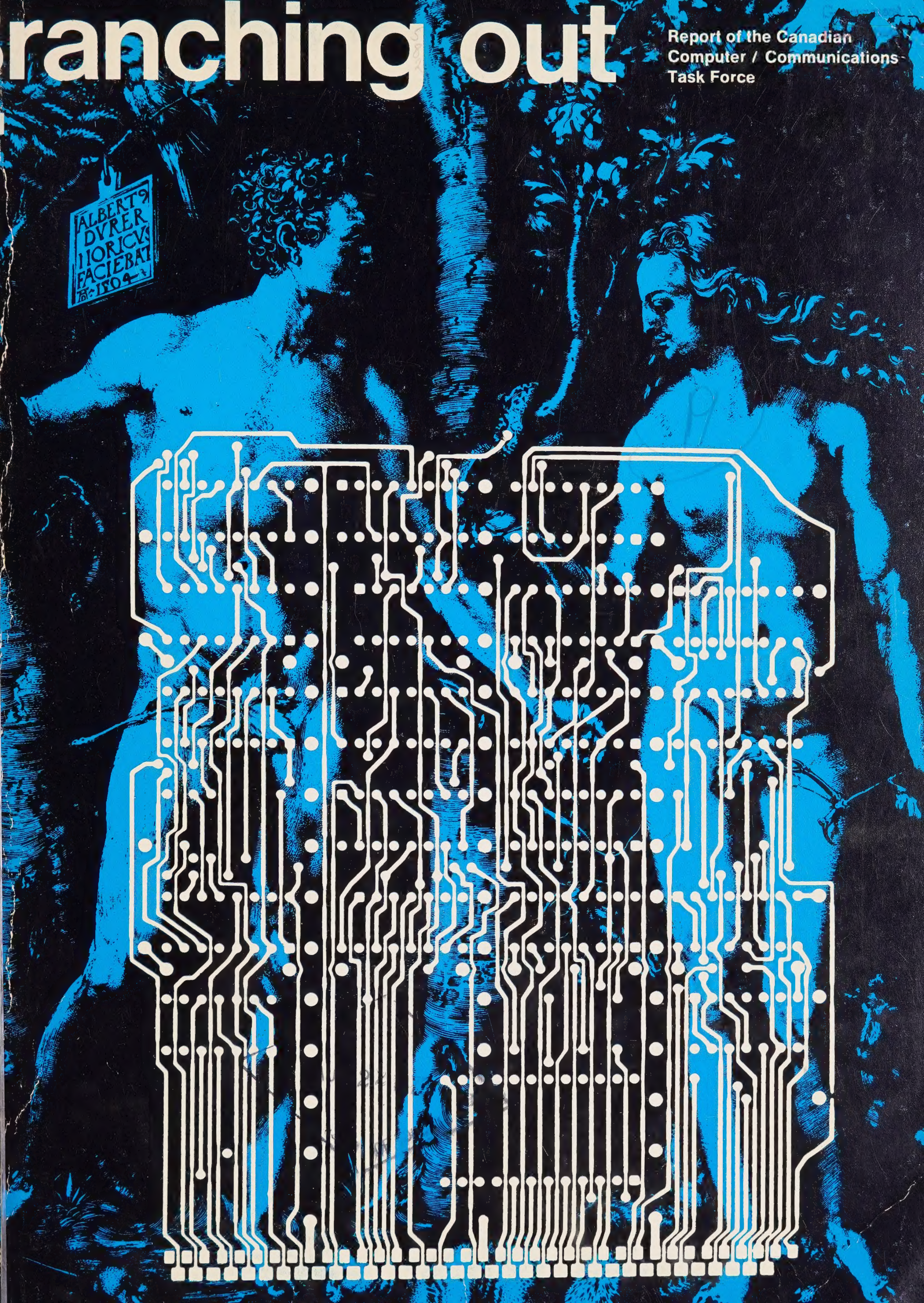
Report of the Canadian Computer / Communications Task Force



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Information Canada
Ottawa, 1972

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Report of the Canadian Computer / Communications Task Force

Vol. I

Department of Communications
Ottawa, May, 1972

Cover design, figures and tables conceived by Gilles Robert + associés, inc
Editors: Pamela Fry and Fernand Doré

Conception graphique de la couverture, des figures et des tableaux: Gilles Robert + associés, inc
Révision et conception de la publication: Pamela Fry et Fernand Doré

The Honourable Robert Stanbury
Minister of Communications.

Sir, *I have the honour to submit the Report of the Canadian Computer/Communications Task Force. The Report presents the main findings, conclusions and recommendations derived from the mass of information collected by the Task Force during the past eighteen months. There are also background documents and contract studies which will be available for examination.*

I should like to take this opportunity to express my appreciation of the constant support given by the officers and staff of the Department of Communications throughout the duration of this project. At the same time I should like to stress that the work of the Task Force could not have been completed successfully without the generous co-operation of individuals and groups in the federal public service, in the governments of the provinces, in the private sector and in professional and industry associations.

H. J. von Baeyer

H.J. von Baeyer.

This Report in all its aspects represents the work of an independent Task Force. The views expressed are not necessarily those of the Department of Communications or of the Government of Canada.

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PREFACE

Under the leadership of the federal Department of Communications, a number of experts from industry, governments and universities studied, during 1970, the whole field of telecommunications in Canada. This project, known as the "Telecommission", resulted in a general report entitled *Instant World*, published in April 1971 by Information Canada. It was followed by the publication of a number of studies covering many varied aspects of telecommunications in greater detail.

Part of the Telecommission study was concerned with issues and problems that arise from the rapidly-growing use of remote-access computers through communication lines and the expected formation of computer networks spreading throughout Canada and the whole world.

Instant World referred to the enormous complexity of issues raised by this marriage of computers and communications and the pervasiveness of the technology which is affecting many segments of political, social and economic existence. Due to the urgent need for a definition of a government position, and the rapid evolution of events in the computer services and communications industries, Cabinet established a Task Force under the auspices of the Department of Communications

Thus, the work of this Task Force has grown out of, and continued, the Telecommission studies. For this reason, the broader aspects of computer/communications as part of the over-all telecommunications picture must be viewed in the light of the preceding Telecommission investigations, particularly as summarized in *Instant World*. In order to avoid lengthy repetition, it is assumed that the reader of this report is familiar with *Instant World*, so that this report's degree of specialization will not detract from a full understanding of the broader issues.

This document culminates in a set of policy recommendations for consideration by the government. Its major objective has been to consider computers and communications in Canada in the nineteen-seventies. It is an attempt to sort fact from fiction; to differentiate between probabilities and promises; to take stock of the current situation; to determine the likely direction for future development; and to recommend fundamental policies to prepare for that future. Details of the Task Force organization, its aims and objectives, its approach and methodology and its major program stages are contained in Appendix 1. Throughout the Report, there are references to representations made to the Task Force on specific points. In order to preserve anonymity, the particular respondent is not identified. However, Appendix 1 contains a list of those who have made written submissions to the Task Force.

In order to achieve the greatest degree of clarity and organization, this Report is presented in two Volumes. Volume I has been divided into six parts. Their sequence is as follows:

Part A contains an overview of the computer/communications field in Canada, and discusses some of the eventual promises which computer/communications may fulfil. It describes the Task Force findings as to the present and expected state of the industry, the possible social and economic impact of computer/communications technology and the needs and problems of computer/communications users. It attempts to forecast the prospective market, on the basis of normal trend extrapolations, and to comment on the realism of such a forecast.

Following Part A, all subsequent sections of this report are recommendation-oriented, relating directly to the various aspects of recommended government policies.

Part B puts forward the fundamental policy approach and presents some general policy recommendations.

Part C is addressed to policy recommendations in the field of the computer services and data communications industries. It indicates the limits within which business and industry should operate and describes the particular areas in which there is a need for government concern.

Part D covers recommendations for direct government action for the stimulation of growth in the private sector and for promoting developments which would normally not be met by private enterprise — especially in regard to social systems. The recommendations are specifically directed to the federal government and its operating departments. However, the Task Force is well aware that the aims and objectives of the policies described in this Report cannot be achieved without a concerted approach, not only at the federal level, but at the provincial and municipal as well.

Parts B, C and D are function-oriented, *i.e.*, they describe issues, and recommend policies and actions without reference to the organizational measures needed for implementation.

Part E discusses the institutional arrangements necessary to perform the functions recommended in the preceding parts. It deals with organizational requirements within the federal government, those required to provide the necessary interaction between government and industry, and considers requirements for federal-provincial co-ordination.

The importance of this division between the "what" and the "how, by whom" should be particularly noted. Its purpose is to permit an understanding and assessment of functional needs, regardless of the individual institutional solutions, before proceeding to decisions on the preferred organizational structures. It is of marked importance in the examination of issues where constitutional factors pose complex problems of federal and provincial jurisdiction.

Part F, the final section, contains brief concluding remarks on the over-all approach taken by the Task Force.

Volume II has been divided into two parts. Part A examines in some detail the jurisdictional and legal aspects of computer/communications in Canada. Part B presents three Task Force investigations of the impact of computers and communications under the following headings: "Automation of Payments and Credit"; "Applications in Education"; "Computers, Communications and Canada's Health Care Delivery System".

It should be understood that the facts stated and the views expressed in this Report are derived from a large volume of information and statistics collected by the Task Force. Wherever possible, these will be presented in background documents and contract studies to be published later.

SUMMARY

Based on wide contacts with all levels of government, industry, business and public institutions, the Task Force studies have fully substantiated the Telecommission conclusions concerning the critical importance of computer/communications in Canada. In particular, the Task Force emphasizes the general pervasiveness, both actual and projected, of computer/communications throughout the Canadian social and economic fabric, and the consequent necessity for governments at all levels to recognize computer/communications as a key area of social and industrial activity. It therefore urges that governments take steps to strengthen the Canadian industry in this field and to co-ordinate its development to the benefit of Canadian society.

The formulation of national policies requires a unified approach throughout Canada, and must take into account both national objectives and regional interests and values. Close co-ordination between federal and provincial actions is therefore essential. In addition, there must be a high degree of co-operation between the public and private sectors in the development of computer/communications in Canada. Within the federal government many departments are concerned with particular aspects of policies for computer/communications. The Task Force consequently sees the need for a "focal point" in the federal government to work in the area of federal responsibilities and to work with the provinces and the private sector in the formulation and evaluation of national policies in computer/communications.

The policies advocated by the Task Force are centred on two main concepts: first, a strong emphasis on maintaining and developing a competitive and innovative industrial environment throughout the whole field of computer/communications, which combines the two functions of data processing and data communications; and second, a strong emphasis on the role of government in fostering the development and self-reliance of industry, and in maintaining a proper degree of Canadian independence in this field.

Specifically, in the provision of commercial data processing services, the Task Force recommends that no restrictions should be imposed on the entry of any organizations into this business, unless such entry would lead to anti-competitive practices not remediable under general competition laws in Canada, or where protection of the consumer interest requires explicit regulations. Under this concept, federally regulated telecommunication carriers wishing to provide commercial data processing services would have to do so through a separate, unregulated affiliate, subject to certain restrictions designed to prevent unfair competitive practices. Banking organizations wishing to provide commerical data processing services would be confined to the provision of services which are directly related to the business of banking as defined by the Bank Act.

In the provision of data communications services, the Task Force recommends that (1) government should assume a co-ordinating role in the gradual evolution of a coherent data communication network, essentially based on the networks of the existing telecommunication carriers and aimed at providing the flexibility, variety and cost-effectiveness required for distribution of computer services throughout Canada and for compatibility with foreign computer networks; and (2) in the interest of stimulating innovation in the provision of data communication services, competition between existing common carriers should be encouraged, and independent entrepreneurs should be permitted to supplement certain common carrier services.

In particular, non-carrier organizations should be permitted to interconnect data communications equipment and sub-lease rented carrier facilities for data communication purposes, subject to review by the appropriate regulatory commission responsible for telecommunication carrier regulation. The Task Force further recommends that organizations offering data processing and data bank services commercially to customers through remote-access facilities should be obliged to register with a registrar for data network services.

In order to stimulate the development of computer/communications services, particularly those of broad social significance, the Task Force recommends a number of measures in which the federal Focal Point would play a co-ordinating role. These include close co-operation between the public and private sectors in the standards development process, support of pilot-projects particularly involving regional or nation-wide networks in the public sector, support of the domestic industry through government incentives and procurement policies, support of industrial, government and university R & D programs, and support of professional and industry associations in the provision of training programs in collaboration with educational institutions.

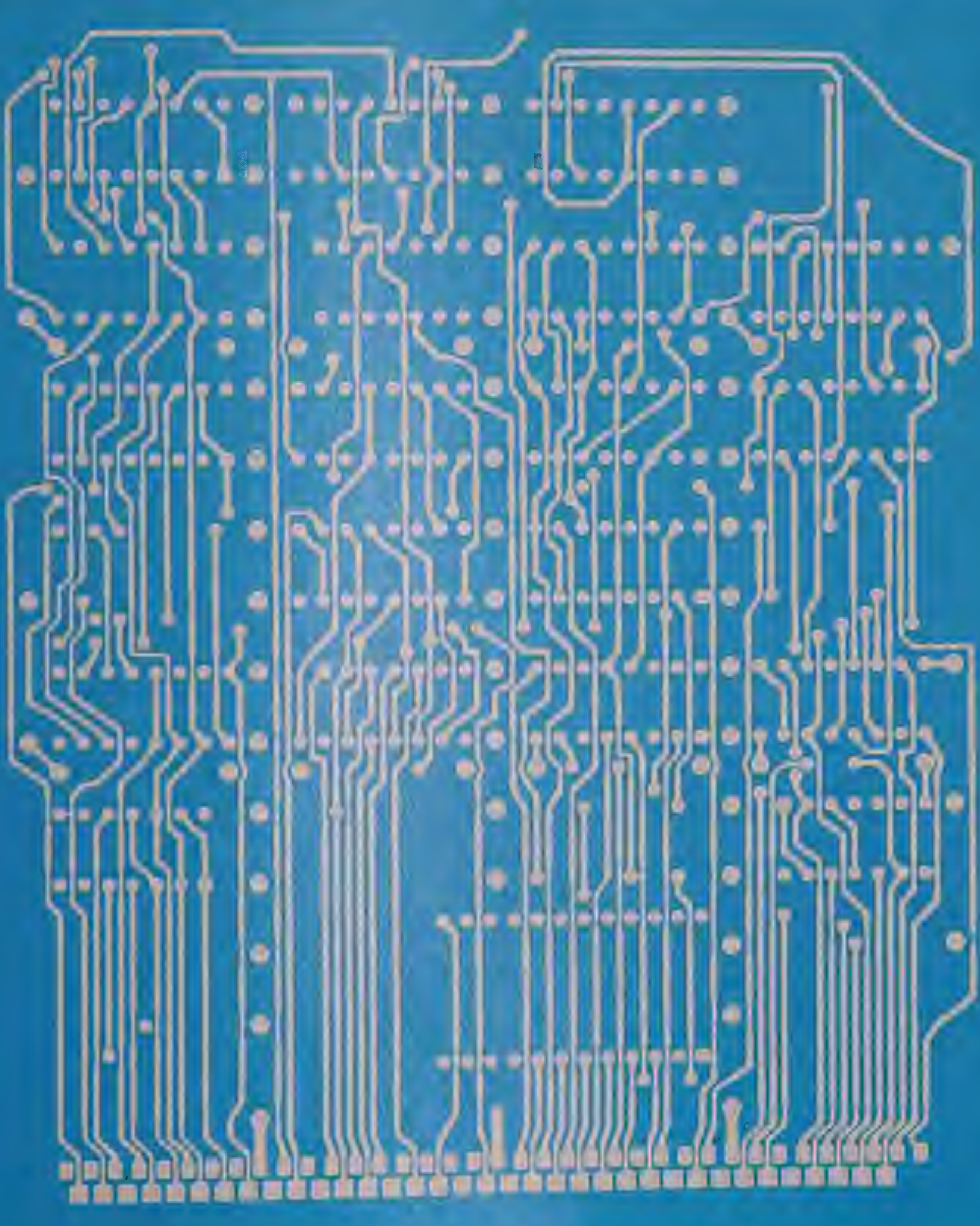
The Task Force was particularly sensitive to the problems of implementing policies of this kind within the complex system of Canadian political and organizational structures. First, there are the governments at federal and provincial level, with their respective constitutional areas of jurisdiction. Second, there is the unregulated industry in the manufacturing, computer service, engineering and consulting sectors. Third, there is the communication service industry, subject to regulation by federal or provincial regulatory bodies. It can be seen that actions towards meeting the stated objectives are bound to cross all these institutional boundaries. The Task Force recommendations therefore, emphasize a close understanding and co-operation between governments at all levels, and between the public and private sectors.

The Task Force has also proposed institutional and legislative measures which are required for implementation of the recommendations. All functions to be performed within the federal government can be allocated to existing organizations. As an interface between government and the private sector, an industrial planning board for computer/communications is suggested, and the role of the existing industrial agencies for development of standards is emphasized.

Part

A

Computer/Communications in Canada: an Overview



Chapter I
Concepts of Computer/Communications Services

Perhaps the most outstanding trend in the evolution of computers is the consolidation of systems and facilities to take advantage of the economies made possible by the rapidly developing technology. Twenty years ago, the transfer of repetitive work of many clerks to small computers represented the first phase of such consolidation. Next, the work of a number of small computers was shifted to a larger installation with lower processing costs per application. The current phase of consolidation is concerned with taking advantage of the remote-access-capability through the merging of computer and communications technologies.

Computer/communications services of the future may be universally accessible from terminals in offices, factories or even homes. Consolidation of computer and communications facilities, and of data stored in public data banks, and the ready availability of common application programs in an integrated system would provide that universal accessibility at a fraction of today's costs through the shared use of common resources. Conceptually, this could make universal access economically feasible and could provide the multiplicity of services required.

The term ''computer utility'' has been used in recent years to describe such potential services, and some present commercial services are marketed under this name. In the Telecommission Study 5(a),(c),(d) and (e), ''Policy Considerations with Respect to Computer Utilities'', a categorization of public and private, general and special purpose computer utilities is given. Considerations relating to the expected development of such utilities were, in fact, major factors leading to the establishment of the Task Force.

With regard to the concept of a general purpose, public computer/communications network, a major supplier of computer equipment and services, in a brief to the Task Force, expressed ''reservations about referring to the ultimate network as a 'computer utility'. Competition in computer and information services can and will exist for a considerable period even though there may be attributes of a natural monopoly present.'' Yet other authorities have recognized difficulties in precise definition of the utility concept, particularly since the term ''utility'' in the provision of services (such as gas, water, electricity or telephone) has a number of legal and popular connotations. Important among these are: an essential service required by a wide segment of the general public; a ''natural'' monopoly within a franchised area with the obligation to provide service on demand; a ''plug-in'' capability, with users obtaining and utilizing the services available with little individual effort on the part of the user on a continuing basis. As yet the computer/communications services industry has few of these characteristics:

- The number of users of computer/communications services is still relatively small. For most applications, users need special skills to take advantage of the capabilities of the computer and, at present, only a fraction of the population possess such skills.
- There are already a large number of highly competitive members of this service industry.
- Capital requirements for initial entry into the industry are not so high as to act as a restraint to entrepreneurs.
- The services offered are many and varied and are available from a variety of sources, by comparison for example with the telephone system, which generally provides a single service although in a variety of forms.

Whether the many services will progressively evolve into an integrated, readily accessible network of computers having the characteristics of a general-purpose public utility cannot easily be foreseen at this time. F.G. Withington, of Arthur D. Little, Inc., in a presentation to the 1971 Annual Conference of the Association of Computing Machinery suggested that:

"The data processing industry, rather than becoming a utility, will become more like the retail food industry, realizing economies of scale for mass products through automated agricultural and supermarket networks, but also providing a rich variety of specialty foods and services, ranging from gourmet and diet stores to 24-hour delicatessens at premium prices and dock-side fish markets at minimum prices. Opportunities will be many and so will failures, but — one thing for sure — any competitor who tries to remain within one of the traditional subdivisions of the computer industry, however large, will be lucky if he is around in 25 years."[1]

Consideration of the possible development of general-purpose public computer/communications services involves three aspects: First the aspect of the technical and economic viability of a computing centre offering a multiplicity of services to a wide range of customers. Second, the aspect of customer access to such computing facilities, requiring the development of a nation-wide, public data communications network. And third, the aspect of resource-sharing by different computing centres in the network, requiring development of sophisticated software. These points are considered in the following discussion.

The concept of broad-range public computer services implies that there are economies of scale inherent in large-scale public computer/communications service networks and that these would result in consolidation of facilities through the replacement of privately-owned computers in a manner analogous to the replacement of individual electrical generators by common generating and distribution systems. In the light of the economies of scale that large computers are reputed to achieve, and in view of the fact that user organizations have been under pressure to reduce computing costs, it is surprising that the expenditures on commercially-offered computing services accounted for only about one-tenth of the total for data processing in Canada in 1970-71.

In order to look more closely into this paradox, the Task Force visited some 60 user organizations, and interviewed representatives of senior management and of data processing management in each, with a view to obtaining information on the potential market for public computer services and on the factors which would favour or inhibit the growth and development of systems which would supply such services. This is described in further detail in Chapter V.

[1] Withington F G quoted by Smith William D Future of the Computer is Assessed *New York Times* August 5 1971 pp 45 & 50

The most striking fact which emerged from these investigations was the wide variety of services provided at the present time through individual computer/communications systems. It was apparent that many private as well as commercial computer/communications service networks have already been established and that their services fall into two main groupings. The first group is the one whose main purpose is to offer remote computational capability. In general, the user designs and maintains his own programs which are then run through terminals, usually on his own premises. To supplement the computing service, a library of general-purpose application and utility programs is often made available. Second, computer/communications service networks have been formed to provide specialized functional or industry-oriented services. Examples of these include the hotel and airline reservation systems, order entry and invoicing systems, text editing, message transfer and information retrieval, services for real estate property management, doctors' and dentists' billing services, and services for freight forwarding and other industries. This list is by no means comprehensive. The main characteristic of such specialized services is that the customer has only a limited capability to modify the programs used and the services provided. These specialized networks are characterized by having more customers than the remote computational networks of the service bureaux.

Some user organizations operating their own in-house facilities also make use of commercial, general-purpose service bureaux on a limited basis, for work overflow or for specialized programs or packages. But the main requirement appears to be for specialized computer/communications services, usually to supplement the functions performed on their in-house computers. Such services are attractive to customers because they usually cannot be economically developed by a single organization for its own use, or because they require skills which may not be readily available to the customer organizations.

The current trend in the provision of private and public computer services is to establish a specialized, dedicated data communications network for each system. Large corporations and government agencies, for their own in-house use, and remote-access commercial service bureaux, are designing dedicated networks reflecting the specific requirements of their systems. Usually, the network control logic is programmed into the main or front-end computer and carriers provide the passive element of the network — dedicated data transmission links between the main computer and terminals or satellite computers. In some cases, connection to the telephone, TELEX or TWX networks provides limited accessibility for the more distant or the low traffic terminals.

An alternative to the formation of a multiplicity of basically incompatible dedicated computer networks, and a next step towards the provision of broad-range public computer services, is the development of a general purpose data communications network providing widespread access to a multitude of specialized computer services. Policies for the development of such a general-purpose data communications network are the subject of discussion in Chapter IX of this Report. Eventually such a network is expected to have many attractions for its users, but a number of economic, technical and institutional problems need to be solved before such an undertaking becomes a commercially viable proposition. Its main features are: universal accessibility where so desired; cost-reductions to users through sharing of common network resources and through implementation of standard techniques and practices; lower cost of developing new services as the need to develop the network control logic repeatedly for each system or application disappears; and flexibility for change caused by new customer needs or technological progress.

A further stage of development, and one of much greater technological complexity, is the full resource-sharing computer network. Users would have access to combinations of any of the devices in the network, to any specific computer configuration, or combination of computers and data banks, in order to meet their needs in the most cost-effective way possible with the total combined computing and communications network resources. However, the technical problems in achieving compatibility of operations of geographically separated data banks and computer systems of different types and characteristics, are still of such dimensions that their commercial viability is not yet in sight.

In viewing computer/communications services in the present and immediate future environment a separation can still be made between those functions associated with data communications (the transfer of data in machine-processible form between two or more geographically separate locations) and those associated with data processing (the manipulation and storage of data). However, the Task Force also recognizes that evolutionary technical and economic developments will occur and that these developments will bring the computer and communications functions closer and closer together, thereby significantly altering the structure of the computer/communications service industry.

Chapter II

The Canadian Background and Future Promise

This report, concerned as it mostly is with the future development of computer/communications in Canada, can afford but a small backward glance to assess how far the nation has come. In so doing, it recognizes the dangers of superficial coverage; of overemphasizing some developments; perhaps leaving out others of more importance; and of misconstruing the significance of some of the available information.

Communications-oriented computers evolved from military applications and from academic experiments. In the early nineteen-sixties, projects in universities became the centre of attention, where non-dedicated, time-shared facilities were established to take advantage of the computer memory's extremely fast internal speeds. These projects demonstrated the feasibility of a central computer complex, serving users at remote terminal locations at the same "apparent" time. Each user, working separately, had at his disposal the equivalent of his own computer system. It became evident that many of the concepts employed in the military and academic environments had potential commercial applicability. As the hardware manufacturers were closely associated with these developments, they were quick to take advantage of the much larger market potential offered by the private sector. It was not until about 1962, however, that the first commercial experimental applications proved feasible, and perhaps not until 1967 that commercial computer/communications systems were becoming widespread and viable. In this period, and up to the present, hundreds of applications have been developed to serve the needs of private and public organizations and institutions.

Perhaps the foremost Canadian development in this field was the automatic reservation system for Trans-Canada Airlines (now Air Canada). From about 1958 to 1962, this project was planned and organized to take the fullest advantage of the country's indigenous resources in both equipment and manpower. Ferranti-Packard Electric Ltd. of Toronto was commissioned to provide the computation and other equipment. The system was based on dual Gemini computers for which all of the detailed logical design was carried out in Canada. It became one of the world's first commercial on-line, real-time systems. An outstanding feature was the transaction-oriented operator's terminal using simple mark-sense cards — an early forerunner of a type of technology which even now is still in its infancy.

The success of the TCA system led Ferranti-Packard into making Canada's most illustrious bid to enter the computer mainframe design and manufacturing field. This was the ill-fated FP6000 General Purpose Digital Computer project, which incorporated many features generally considered to be the then current state of the art. A number of orders were received from those organizations courageous enough to place their faith in a system which lacked the test of time and a handful of deliveries were made. However, it soon became evident that the costs associated with development, marketing, distribution and maintenance had been underestimated and were growing at a much faster rate than the sales could support. At this point, after vainly seeking aid, the company decided to abandon further development of the system in Canada. One can only speculate on what might have transpired if sufficient funding had been made available, or if more Canadian organizations had been willing to place firm orders.

In many ways, the Consolidated Computer Company's experience over the past two years reads like a re-enactment of the FP6000 story. Their Key-Edit system was designed to overcome the inadequacies of key-punch and key-tape units by utilizing a mini-computer for editing and verifying the preparation of data received from a number of input stations at electronic speed. Although it was a conceptually sound design, and met a definite need, the company's problems in meeting cash-flow requirements provided yet another instance where the merits of a product were not sufficient on their own to guarantee its success. Recently funding has become available, promising a more secure future for this system.

If one is to measure success in terms of favourable response, then the software developments which have emerged from the experiments at the University of Waterloo are of considerable merit. Starting from the recognition that lack of sufficient computer time encumbered students, a professor and three students designed and wrote a programming language compiler with the purpose of increasing machine utilization. The team's success has made the WATFOR compiler a familiar name in university computer centres around the world. Other software developments have emerged since the debut of WATFOR which have added to the University's list of achievements. WATFOR has since been extended and refined under the name of WATFIV. Their success has indeed become self-evident, because in addition to several other universities, a large number of institutions and commercial organizations have availed themselves of these software packages.

Another significant software development in recent years is APL (A Programming Language). Although it is not an original Canadian development, one Canadian company has done much to popularize this system of programming, particularly in interactive business applications. The concept involved is essentially that of making the computer "transparent" to the user by means of an on-line terminal, whose key-board has been modified to include powerful operators, the equivalent to many normal program instructions. As a consequence, it is claimed that non-programmers can produce useful output within two or three hours of exposure to APL, which is a little longer than the time required to learn to operate an electronic desk calculator. The significance of this development is that it may have a profound effect on the future usage of computers by small businesses.

This miscellany of Canadian developments provides only a taste of the work already accomplished, and what has been achieved to date. These examples and other similar developments lend credence to a number of frequently mentioned observations, which will be explored more fully in later parts of the Report.

Canadian expertise is second-to-none in high technology areas. Many developments are far advanced and, given the opportunity, can continue to be the equal of all but the very largest developments. The major Canadian failing lies in our inability to fully exploit opportunities and insufficient clarity in the

definition of objectives. There appears to be a delay in the acceptance of Canadian technological developments until they have been acknowledged by other countries. This has the combined effect of producing heavy marketing costs, as well as indicating a discouraging lack of confidence in our own products.

Sufficient funds have been lacking at critical stages of development and marketing for hardware and software innovations. There are hopeful signs that this particular problem has begun to be recognized and that it may be more easily resolved in the future.

The common theme which seems to emerge is that advances have been achieved mainly by small, dedicated teams of individuals, brought together by the stimulus of high quality leadership.

As the situation now stands, the more successful applications appear to have been those using dedicated facilities. In particular, reservations systems for airlines, hotels, railways, theatres and for other discrete events have benefitted from the ability to access and update large files of information from remote locations in a matter of seconds. Similarly, process-control applications for monitoring oil refineries, pipelines and other flow processes now require little human intervention, having been equally successful. On the factory floor, good progress has been made with data collection systems feeding information by means of communication lines to central computers in order to monitor work in process against predetermined schedules. These are but a few examples, and the list of successes continues to grow.

There have been a number of failures, and it would be misleading not to mention them. In particular, the development of Management Information Systems cannot be said to have achieved the degree of success originally envisaged. The concept of an organization's total information being processed directly by a computer, with each level of management receiving that amount of information necessary to fulfil the responsibility involved, is most appealing. But results thus far have fallen short of expectations, and the real usefulness of computers for managerial decision-making has not yet reached an advanced level. Furthermore, a general disenchantment with computer systems has arisen, where management's expectations and funds expended on data processing functions have not been met with satisfactory returns. In the long run, this will be all to the good, for it will mean that in the future, projects will receive more critical appraisal in the early stages. This view lends credence to the reputed shift in emphasis taking place within the industry which suggests that the hardware orientation of the last few years is giving way to much more of a total service approach. As a consequence, the relative expenditures on computer/communications products and services will change to reflect this shift in emphasis, as depicted in Figure 1.

Two points emerge which deserve attention. First, the use of communications in conjunction with computers has transformed these instruments from on-site tools to interactive extensions of the individual whose location may be thousands of miles from that of the system being used. A person in Frankfurt booking a flight from Rome to Bangkok may well be oblivious to the fact that

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n Expenditures by Users

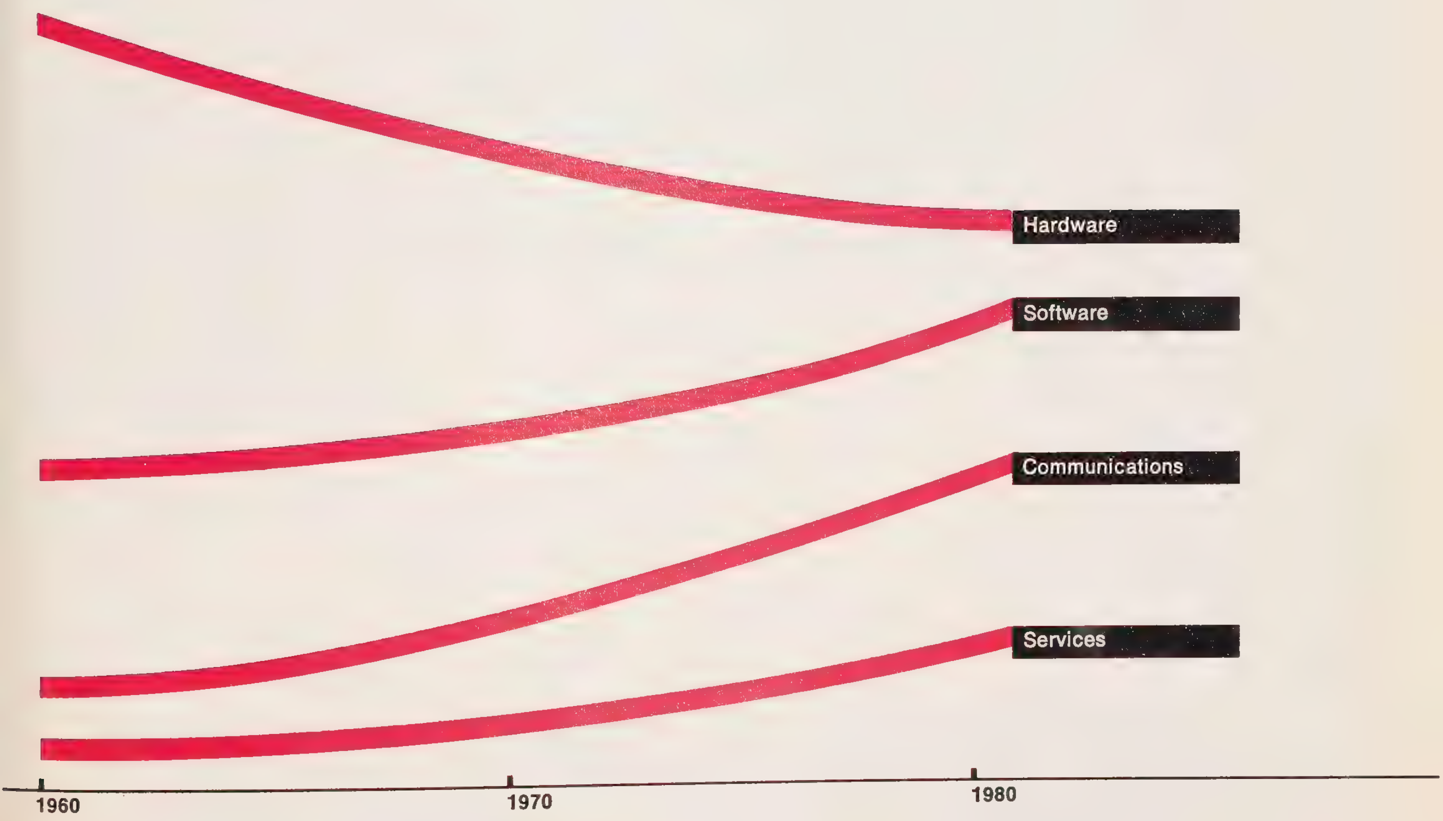

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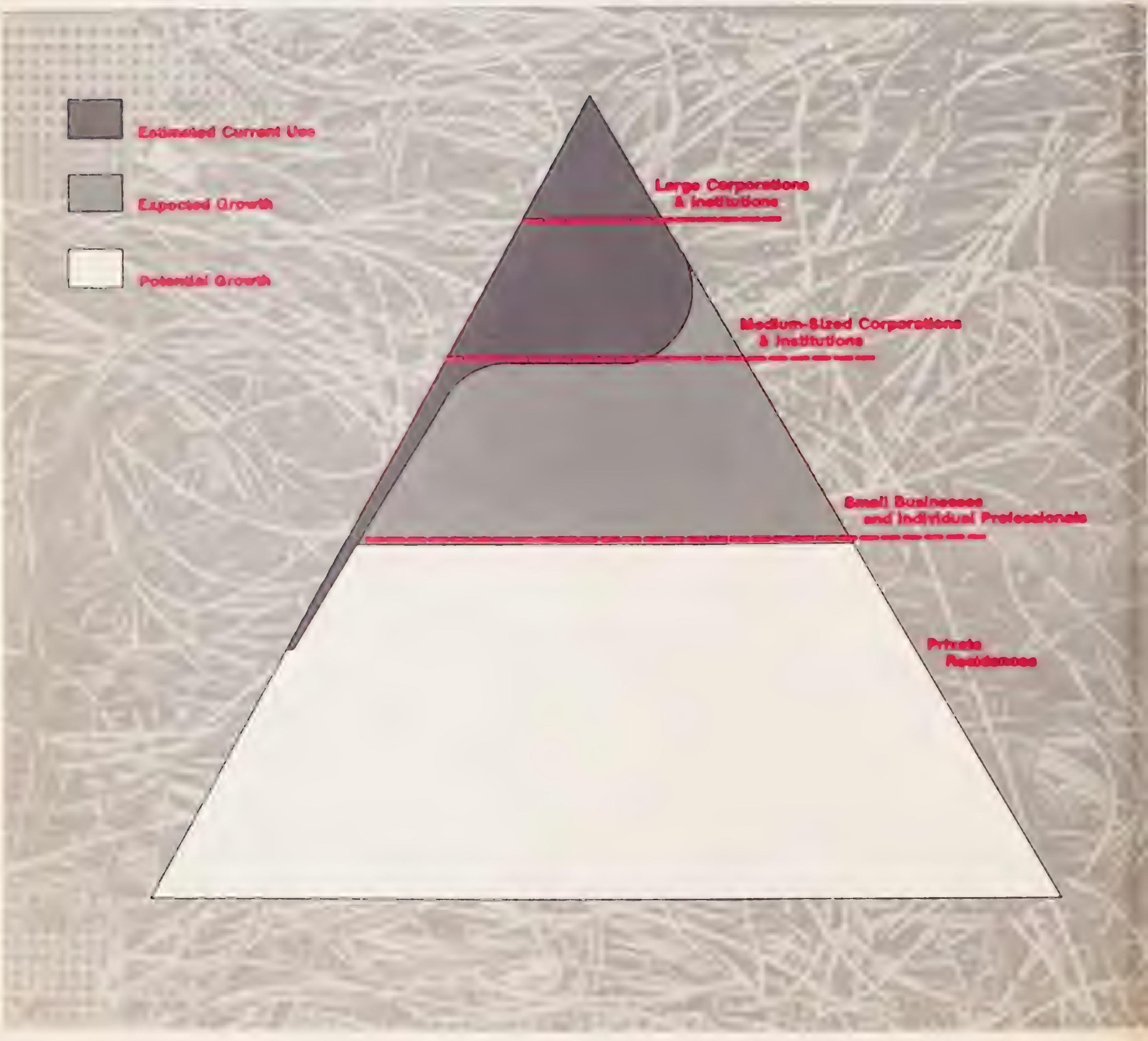
Figure 2
Usage of Computer/Communications Facilities and Services



the processing of his reservation is taking place in New York City. Thus, as far as the end-user is concerned, the physical location of computational facilities is inconsequential, although this could well become of increasing concern to governments. Second, the direct use of computer/communications facilities and services remains limited to a relatively small part of society. Only large and medium-sized corporations and institutions make extensive use of computer/communications technology at the present time. While it is not feasible to assign values to potential usage, in terms of numbers these organizations probably account for less than 10% of the total; small businesses represent perhaps another 20% and households perhaps in excess of 70% of the total potential number of users. Figure 2 illustrates this point.

While potential expenditures for computer/communications goods and services will not be in the same proportions as the numbers of users in these categories, it is nevertheless clear that the bulk of the potential market remains unexploited. This essential fact gives rise to optimism with regard to the long-term outlook for the industry.

For example, when examining the future direction of computer terminal usage, observers point to the telephone — one in every home. Whether the demand for home terminals, or rather for the services they could provide, will materialize is open to question. Among the possible services postulated for the future are:

- *Electronic Mail.* Public messages and postal letters may be supplanted by private messages from home terminal to home terminal via a switched network. Prices will vary according to urgency and length of message, but would need to be cheaper than telephone over long distances.
- *Electronic Newspapers.* A terminal used to access only those portions of newspapers that are of interest, *e.g.,* sports pages, financial news. Alternatively, some terminals may be equipped with facsimile devices which reproduce complete newspapers, or the journal of choice, directly in the home.
- *Computer-Aided Instruction and Computer Tutor.* A range of courses on every conceivable subject with a view towards the completion of a specified course of study with appropriate examinations, or simply towards satisfying personal interests. The terminal display and keyboard are used to interact with the computer.
- *Family Accounting.* Anticipated gross and net income for a year are placed on file, together with the family budget by category of expense. As expenditures are made, these are deducted from budget to indicate funds available. At year end, income-tax is computed and the next year's budget is calculated on the basis of actual disbursements.
- *Video Library.* The home terminal display screen is used to ascertain the films or books available for viewing and their price. After final selection (perhaps by sampling) and viewing, the cost is debitted to the subscriber's account.
- *Grocery Pricing and Ordering.* Based on a particular family's needs, a series of menus is computed for the week. The total grocery requirement is then ordered via a central computer from one of a number of neighbourhood stores whose total price to the consumer would be the lowest.

The above examples illustrate the range of possibilities for services to the home, but the potential market for small businesses and professional persons will probably materialize earlier. This is because when effective systems have been implemented, and when the price of service declines sufficiently to compete with the book-keeper or clerical assistant, the needs will be

transformed rapidly into effective demand. Thus, in contrast to the fulfilment of home needs, the service will be regarded as a normal business expense. The type of service required initially will probably centre upon accounting packages, where the information could be transmitted by means of a telephone line from the place of business. This service, plus others of a more sophisticated nature, will be required by doctors, dentists, lawyers, architects, engineers, and consultants. The degree to which these services may be made convenient to the professional will play a large part in determining the growth of this market. Even before this occurs, it is probable that the rising costs of social programmes will force governments to seek relief through the application of various technologies, thus generating a substantial demand for computer/communications equipment and services in the public sector.

What then are the expectations for the implementation of such services?

As indicated previously, the potential market for services to the home is numerically larger than all other markets combined. The fact is that the technology to accomplish these things, and much more, is a near prospect. As partial evidence of this, a number of entrepreneurs in the United States have already embarked on such schemes as:

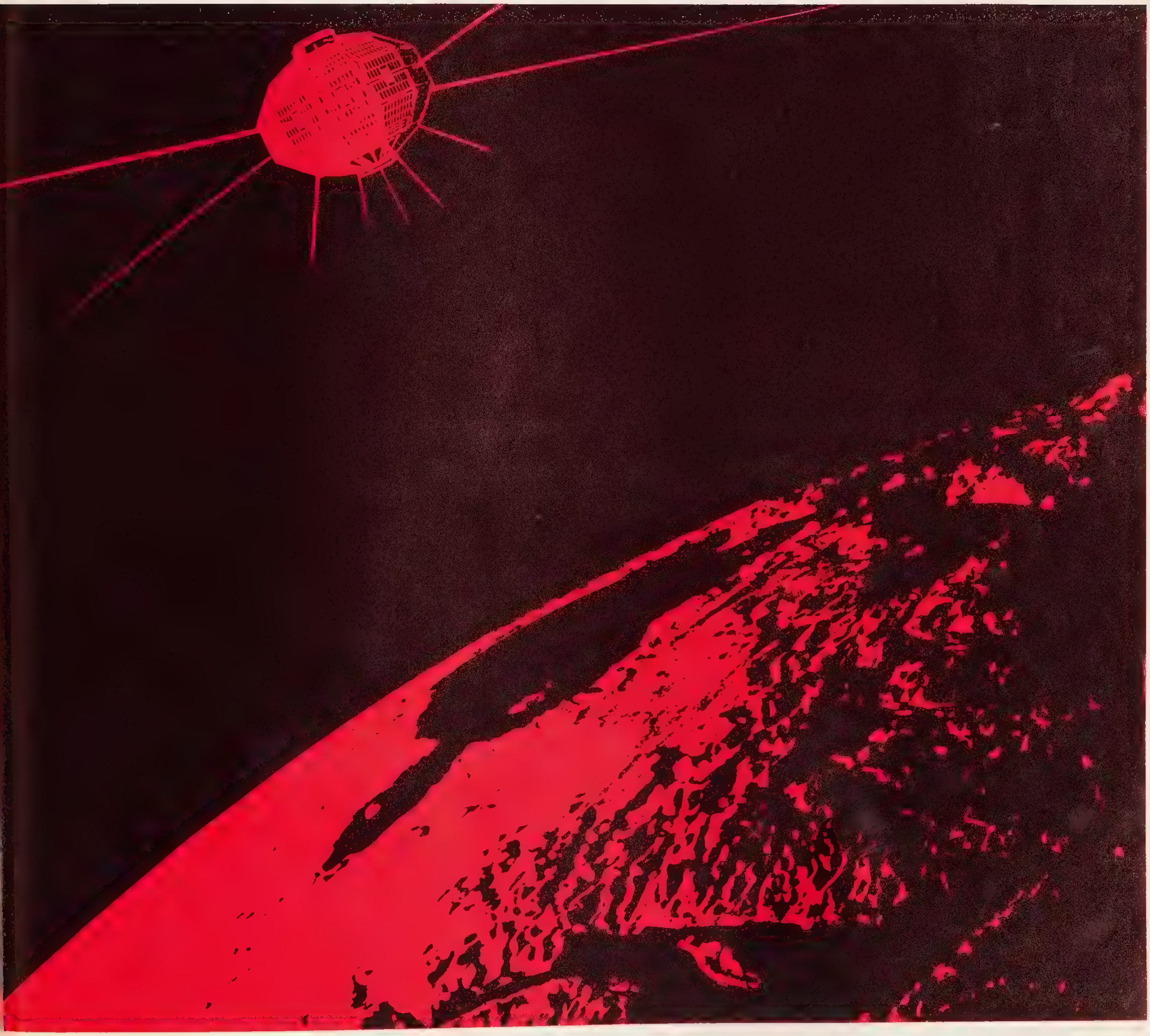
- The provision of simplified computer terminals for each house in a new subdivision, connected to the subdivision office computer, primarily for protection against burglary, but also with the aim of providing cooking recipes and a variety of other services on demand.
- The installation of a coin-operated computer system which allows the user a choice of programs which may be of interest.
- The establishment of a computer-operated bingo game over a modified local CATV station network, which allows two-way communication for a limited number of participants.
- The installation of cash register terminals in the stores of an Ohio town connected directly to the local bank's computer which instantaneously debits the purchaser's account with the value of a sale and credits the store with a like amount, minus commission (often referred to as the first example of the cashless-chequeless society).

The evidence seems to suggest that as the price of equipment falls, more and more experiments like these will be undertaken to determine the viability of satisfying consumer-level and small-business demand. As tantalizing or as frivolous as some of these services may appear, it would be foolish not to take them seriously. The history of technological forecasting indicates that the majority of predicted techniques or inventions do in fact take place, although seldom in the time predicted — often much sooner or much later than expected. What is needed is to channel some of these experiments towards high priority, socially-desirable outcomes, rather than simply to add to our list of entertainments. By way of example, the potential in terms of assistance to health care or educational instruction by means of computer/communications technology is large.

Such new developments will pose many problems for governments in particular, and for society in general. There will be problems relating to priorities; to jurisdictions; to questions of who should be allowed to provide which services; to the displacement of persons in industries and institutions which may become obsolete; and problems of leadership in the face of possible societal fragmentation. Other questions will of course arise when consumer choices and opinions are made known. Will we prefer to read *Le Devoir* of Montrel, or *Le Monde* of Paris, the Toronto *Globe and Mail* or the *New York Times*, if all were electronically available? Will the sending of messages and the writing of letters become forgotten pastimes? Is ''Bingo Night in Canada'' inevitable (or even desirable)?

Answers to many such questions will be required in the decade ahead.

Chapter III
Computer/Communications and Society



Introduction

The field of computer/communications has had its widest application in serving the administrative and operational needs of businesses, industries and institutions. However, there are an increasing number of applications affecting Canadian society and the individual. Social considerations have therefore played an important role in the deliberations of the Task Force. The area of concern is wide-ranging. It encompasses the whole technology of computer/communications because of the effects the application of the technology may have on individuals, on groups, and on society as a whole. There are those who view the development of these effects as a process of enslavement, fearing that man will become subject to the whims and fancies of some giant computer complex before the realization of its existence is fully upon us. Others take the opposite view, and are convinced that the technology will liberate mankind from the drudgery of routine and repetitive work. However, if the experience with computer/commmunications systems over the last decade is a reliable indication of what the future may hold it is unlikely that either of these extreme situations will materialize. Most observers agree that the impact of the technology thus far has been neither as good nor as bad as predicted. On the other hand, experience in this field may not be the best basis from which to judge the future course of events. The pace of change in computer/communications technology may well out-distance our ability to deal successfully with the problems that it will undoubtedly raise:

"The anonymity of the computer is about to disappear, for it now appears likely that the coming era will carry to fulfillment a gigantic revolution in the generation and distribution of computer power. Before that revolution has run its course, the computer will have become as much a part of our daily lives as is the telephone today, and our society will probably have been altered almost beyond recognition."[1]

If this premise is accepted, that our society is going to be altered drastically by computer/communications technology, then, before bowing to the inevitable, it is entirely appropriate to attempt to guide the future course of events as much as possible to our own advantage. In order to achieve this, at least three types of goals would appear desirable:

- To recognize and utilize those computer/communications systems which directly serve, or are of benefit to, society;
- to optimize the use of scarce resources by recognizing and assigning higher priorities to those socially-desirable applications which promise the greatest benefits; and
- to recognize and mitigate to the greatest extent possible the undesirable side-effects of the application of computer/communications technology.

[1] Parkhill, D. F., *The Challenge of the Computer Utility* (Addison-Wesley Pub. Co., 1966)

While the general direction as to what should be done may seem clear, it may be infinitely more difficult to put policy into practice. The problem is vastly complicated by the very adaptability and pervasiveness of computer/communications. It seems evident also that there is no sharp dividing line between those systems which are directed towards serving society and those systems which, ostensibly, appear to serve essentially economic goals. All types of systems are capable of having both beneficial and detrimental effects. The changing technology combined with the imagination of man make it extremely difficult to assess where and how the next applications will develop, and precisely what their effects on society and the individual will be.

1. CONSIDERATIONS OF BENEFITS AND EFFECTS

The use of computer/communications technology as a tool which could serve society has only recently evolved. With this evolution has come a wave of potential applications varying from medical diagnosis to housework, and some of these have been cited in Chapter II. This vision of the technology being able to provide the ultimate solution to all of today's ills was particularly prevalent during the mid-sixties, to the extent that new problems were being sought for which there might be a technological solution. The rush to apply the technology tended to overlook two important questions:

- Was there a clearly defined problem to solve?
- Was computer/communications technology the best means of solving the problem?

In the recent difficult economic climate, a more pragmatic view has developed, coupled with a degree of disillusionment on the part of many users, due to the lack of effectiveness of many computer installations. For this state of affairs, neither the users nor the hardware salesmen, who have tended to oversell their machines and to underestimate the difficulties involved, can be held blameless.

In its review of possible future developments, the Task Force was faced with the problem of determining the means of ensuring that these developments would meet the social needs of Canada. This led inexorably to the difficulties of measuring social, rather than economic, phenomena. Three frameworks were tried, but none seemed appropriate in an environment where the requisite information was lacking and where the constraints were changing constantly. The areas considered were the assignment of social merit; the most frequently identified social applications; and some of the benefits that might be anticipated.

(a) Problems of Measuring Social Phenomena

In identifying possible national goals, the Task Force examined in some detail those already defined by the Science Council in Report No. 4 (1968), *Towards a Science Policy for Canada*. The Science Council, faced with the same dilemma of providing a framework for measuring the national interest, developed a list of six national goals, including an extensive set of sub-goals, qualifying their work with the statement that the list was not comprehensive. These were:

- National prosperity.
- Physical and mental health and high life-expectancy.
- A high and rising standard of education, readily available to all.
- Personal freedom, justice and security for all in a united Canada.
- Increased availability of leisure and enhancement of the opportunities for personal development.
- World peace, based on a fair distribution of the opportunities for personal development.
- (These were subsequently amended by a seventh goal on control of environmental pollution.)

The formulation of a set of national goals is an extremely difficult process in a democratic society. Out of necessity, they are generally aimed at the long-term, while society and its institutions react primarily to short-term issues. What appears as a problem today may not be a problem next year. In Canada, the process is further complicated by potential conflicts between national goals and regional goals. Any list inevitably causes concern because of its omissions and inclusions. The Task Force found that virtually all computer/communications applications could be an aid to their fulfilment, but to what degree remained uncertain. The generality of the goals, and the lack of the assignment of priorities, meant that they could not provide meaningful measures for assessing either the relative importance of a social need, or the applicability of a particular computer/communications system.

The generality of these national goals spurred the Task Force to seek a framework more attuned to the computer/communications environment. To develop a work program for policy analysis, a set of tentative criteria was drawn up:

- Establishing effective Canadian problem-solving and decision-making capacity, by (i) optimizing data processing power and access to data, wherever stored, and (ii) fostering improvements in data collection, processing, dissemination, and utilization.
- Protection of national sovereignty, by (i) maintaining control over data essential to Canada, and by (ii) fostering the growth of Canadian-owned and/or controlled firms, and the growth of Canadian skills in the computer/communications field.
- Protection of Canadians from unwarranted intrusions into the life of the individual by the computer.
- Promotion of regional development by (i) ensuring the availability of data to all areas of Canada at costs which are not prohibitive, and (ii) providing opportunities for special computer/communications facilities in the less-developed areas of Canada.

[2] Science Council of Canada Report No 4 *Towards a National Science Policy for Canada* (Ottawa, Queen's Printer (Information Canada) October 1968)

- Rationalization of system structure and design, by (i) avoiding excessive systems cost and unnecessary duplication of facilities, and (ii) avoiding unnecessary obsolescence of useful equipment and unreasonable demands on organizations with obligations of a higher national priority.
- Utilization of private initiative and resource allocation processes, by (i) fostering a competitive environment and (ii) maintaining or introducing restrictions against unfair competition.
- Rationalization of the role of government by (i) ensuring that administrative or legislative policy-making is coherent and practical, (ii) ensuring that no major policy changes are implemented without due process, and (iii) ensuring that adequate jurisdiction and capability resides in the agencies or institutions charged with implementing government policy.
- Optimization of national resource allocation by government, so as to ensure that resources applied to computer/communications are not misallocated to sectors that are low in social priority.
- Ensuring acceptance of computer-communications technology by interest groups and Canadian society by (i) avoiding censorship of ideas, and (ii) providing for adequate participation in the decision-making process by the groups affected.
- Promotion of international co-operation in computer/communications by (i) facilitating international technical compatibility, (ii) participating in international councils, attending international forums, and exchanging information, and (iii) providing Canadian skills and resources to developing countries when requested.

In recent years, there has been an increasing use of analytical techniques whose purpose is to determine which of two or more courses of action should be undertaken when resources are limited. Although the purpose of such techniques has been to determine the most preferable choice among a number of alternatives, their success appears to have been greatest when the alternatives are few in number.

These techniques are known by various names, of which perhaps cost-benefit analysis is the most widely-used. Essentially, they have in common the idea of quantifying the anticipated costs and the expected benefits, in order to determine whether the ratio between the benefits and costs is greater for a given course of action than for another. Generally, however, it seems clear that whenever social costs or social benefits are involved, their quantification remains an inexact art. Only in the most straightforward instances, where inputs and outputs are easily measurable, does the analysis become reasonably practicable. Indeed, it has been suggested that one of the greatest advantages of cost-benefit analysis is the learning process contained in the exercise itself.

At the level of policy development, the techniques of cost-benefit analysis are difficult to apply unless a great deal of information is available regarding the alternatives proposed for consideration. It must be entirely clear as to what is being measured and analyzed. Until a number of definitive proposals have been made (*e.g.,* for a network to link certain hospitals for specific, well-defined functions) it is neither possible to estimate the costs involved, nor to postulate the potential benefits.

Within its sphere of applicability, each of the above approaches to the assignment of social merit has its advantages. However, within the constraints of the Task Force responsibilities and time-frame, the major drawback is the

problem of measurement. There is no easy way to measure social costs and benefits, and even the current use of the GNP as an indicator of economic growth is being criticized for its lack of reflection of the real quality of life:

"...GNP is still the best indicator of economic activity available. But even its most ardent defenders are troubled by the increasingly glaring paradoxes which emerge when it is used to estimate levels of, and changes in economic and social well-being. For example, air pollution doesn't enter the accounts as a cost or negative item but air pollution equipment is dutifully registered as a plus. Littered parks require more park attendants and equipment: up goes GNP. More crime involves more policemen and police cars: GNP solemnly records an increase."[3]

The whole problem of measuring social change is in fact so contentious that there are those who claim that the entire exercise is misleading:

"To make progress in the social sciences, we must give up the (often ridiculous) attempt to measure and quantify social phenomena."[4]

(b) Some Probable Developments

At the present time, it seems that the most appropriate method of determining likely future developments is through an investigation of experienced, educated opinion, particularly when it is held by a large number of people engaged in the same field of activity. On this basis the Task Force identified education, health care, and finance as areas of unquestioned social importance to society. All three areas suffer from a number of problems, and it is generally considered that computer/communications technology could assist towards providing effective solutions. In these application areas special studies were undertaken, and the detailed findings are published in Volume II of this Report. Health and education as services in the public sector are subject to continual discussion and criticism. They directly affect the entire population, both through their functions in society and through the funds derived for their support by taxation. They have demonstrated an accelerating rise in costs throughout the sixties due to rising labour costs, increasing enrolments in educational institutions, and an expanding use of health care facilities. At the same time, a disparity in services between different regions of the country has persisted and there is an increasing public demand for

[3] Ostry Sylvia Economic Council of Canada New Indicators", *The Montreal Star*, June 16, 1971 p 71

[4] Howard N *Paradoxes of Rationality Theory of metagames and political behavior* (The MIT Press Cambridge Mass 1971) p 1

improvements in service combined with a growing dissatisfaction with the rising costs. Less public attention has been focussed on financial services, but they are beginning to play an important role in society because money, in the form of bank-notes and coins, is being replaced by other means of exchange.

Numerous other applications of computer/communications technology are already being developed by all levels of government and by other public institutions, which are directed towards serving the individual and society-at-large. Systems such as those concerned with community information, police information, automated traffic control, legal information, and liens registration portray the extent to which the alleviation of some aspects of the social condition could be met by applications of the new technology. Some of these systems will, of necessity, make large-scale use of network facilities.

The understanding and protection of individual freedom and rights in a free society has been the subject of increased interest in democratic countries in the past few years. It is becoming more and more difficult for the average person either to obtain information concerning his rights, or to understand their implications. Across Canada a number of community information centres have come into being. These vary in form from public libraries to social welfare agencies to store-front operations. Some are directed towards serving ethnic groups, some to social welfare services, while others are geared to legal rights and services. Some maintain extensive files while others operate on a personal contact basis. In recognizing this problem, the Consumers Association of Canada has had a study undertaken regarding the possibilities for providing centralized information to these centres. The role computer/communications could play in this endeavour is being examined as a potential way of providing readily-accessible and complete information to these centres, as well as providing feedback on the nature of individual concerns.

A national police information system, already under development by the RCMP, promises to give all Canadian law enforcement agencies access to such information as stolen vehicles, wanted persons, fire-arm registration, stolen fire-arms, stolen property and criminal records. While this information is already available, access to it is slow, and network access to centralized information could provide quick responses giving an officer information within the time available for action.

The potential value of the computer to the legal profession in the long-term seems assured. In both case law and statute law, experiments have been undertaken by governments and universities with the primary aim of providing rapid information retrieval. The basic problem is that the expanding volume and complexity of our laws has made it more and more difficult for the lawyer to locate the specific information he requires. In consequence, it is becoming more and more costly to provide for the proper functioning of the legal system. The experiments at the University of Montreal — project DATUM/SEDOJ (Documentation Automatique des Textes juridiques de l'Université de Montréal — Service de DOcumentation Juridique) and at Queen's University (project QUIC/LAW) are concerned with case and statute law retrieval and there are reasonable expectations that they will prove

capable of adaptation for wide, practical application. The Manitoba Government and the federal Department of Justice have developed statute law data banks from which various indices can be extracted. The Department also utilizes a computerized photocomposition system for draft legislation, a process which enables changes in texts to be introduced rapidly and easily.

These few examples of the types of systems already serving or beginning to serve society, suggest that wherever problems are evident concerning the collection, storage, manipulation, and retrieval of large quantities of information, computer/communications techniques are regarded increasingly as the natural solution.

(c) Some Possible Effects

While the magnitude of the applications of computer/communications can be surmised reasonably well, much less is known or understood about the effects of this technology on society. Even educated opinions are expressed hesitantly because of our present lack of knowledge of meaningful methods by which to observe or measure social change. It is conceivable that the indirect effects of systems which appear, at first sight, to have little potential to affect the individual or society may have much greater impact than anyone can foresee. We should be concerned, therefore, not merely with systems directed towards serving society but with all computer/communications systems, however far removed they may appear from contact with the individual.

Few research programs have been undertaken to study the effects of computer/communications technology on society, and little of real significance has been produced by the research currently underway. As an example, IBM funded a $5 million project at Harvard to study Technology and Society, which began in 1964. A recent description of this project stated:

''The program is the only sizeable project of its kind anywhere. Because the subject matter — society and technology — is a new discipline, it was expected from the start that it would take some time to get off the ground. When the program was established in 1964, it was stated: 'The area of proposed research is relatively new and lacks well defined problem definition and methodology.' A successful approach is most likely to develop from an effort spread over a relatively long period, approximately 10 years, during which the intellectual resources of the University can be gradually deployed to mount a substantial and coordinated effort on this class of problems.''[5]

The article goes on to point out that in spite of the 40 or so research projects undertaken to date, it has been unable ''to produce much of note'', and the effort is being disbanded at the end of the 1971-72 academic year.

[5] Gardner W David, 'Harvard Will 'Redirect IBM-Funded Study on Technology and Socity *Datamation* August 15 1971 p 38

Some other studies are underway, many with more specific terms of reference than the Harvard programme. For example, the Manchester Business School in England has undertaken a five-year study of the sociological aspects of introducing computer systems.

The problem of identifying and measuring social parameters seems to be a major stumbling block. Gabor Strasser, at the U.S. Office of Science and Technology, stated recently that there is little understanding of which indicators are relevant to measuring the quality of life, what their interrelationships are, or how to measure them.[6] Few analytic techniques are available which can use qualitative rather than quantitative information, and yet the qualitative information is more relevant in assessing social change. The following analogy with mathematics illustrates the point:

"Nonmathematicians often think that mathematics is primarily concerned with numbers. That is not so today. In fact, while twentieth-century social scientists have tried desperately to become more quantitative in the belief that this would make them more mathematical, twentieth-century mathematicians have become increasingly non-quantitative. The subjects loosely called modern mathematics (say symbolic logic, topology, modern algebra, and, more than all, set theory) become less concerned each day with common-or-garden numbers. They discuss relations. The idea that mathematics is the science of quantity is a nineteenth-century notion, and social scientists who pursue it are immersing themselves in dead ideas".[7]

Whether or not, therefore, we shall ever be able to quantify and measure the effects of this, or any other technology on society appears to be in dispute. What is clear is that genuine concern exists about the effects, or envisaged effects, that computer/communications technology may bring forth. Whereas the beneficial effects of computer/communications systems have been stressed in the second part of this chapter, little mention was made of the frequently quoted negative aspects and potential hazards. Perhaps paramount among these are the issues of privacy, depersonalization, manpower replacement, and, at the official and political levels, aspects concerning regional differences.

The issues related to privacy are not new. Files of a private and confidential nature concerning individuals, groups and organizations have been maintained for centuries. However, the issues have recently come into prominence because the technology now enables access to confidential information by many more persons than was formerly possible. With the situation as it now stands, there is the danger that such access places not merely the unscrupulous, but also the misguided individual in a better position from which to misuse such information. This is but one aspect of the complex issues surrounding privacy, which is the subject of a special Task Force established by the federal Departments of Justice and Communications.

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[6] Strasser, G., "Impediments to Societal Problem Solving", *IEEE Spectrum*, July 1971, pp 43-48

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[7] Howard, N., *op. cit.*, p 2

A related problem concerns the depersonalizing effects of the use of numbers to identify individuals. No longer, it is argued, is a person an individual with a name, unique features and characteristics. Rather he has become simply a number in a vast bureaucratic system which conspires to obliterate all traces of the human spirit. There may be some truth in this allegation because, in one sense, it reduces the status of man to the equivalent of an automobile part. On the other hand, given our present state of knowledge with regard to data manipulation, not using numbers to identify individuals would make some computer systems much more difficult and certainly more costly to operate. Furthermore, it has been claimed that when numbers are assigned to people, companies and institutions can provide more individualized attention than would otherwise be the case. It may indeed be preferable to be a number if this ensures that we receive the right pay-cheques on time, or that we do not pay another person's taxes.

There is a widespread belief that computers cause job redundancy and manpower replacement. From a survey[8] partly commissioned by the Task Force into the attitudes of Canadians towards computers, some 71% of respondents believe that computers will cause unemployment. There have, in fact, been some instances of redundancy caused by the installation of computers, but the majority of these appear to have occurred in areas of process-control. This more appropriately comes under the wider subject of automation, but where information-processing is concerned, most organizations appear to have added to, rather than reduced, their staff. This is not to deny that dislocations have taken place, that changes have been created in the demands for different types of jobs, and that adjustments have had to be made even while computer/communications are in their infancy. The danger of dislocation in employment therefore cannot be lightly disregarded, and should be a continuing concern of governments.

2. REGIONAL ASPECTS

The size and topography of Canada have given rise to a diversity of conditions within its borders. Nevertheless, in spite of the well-known social, cultural, linguistic, economic, and geographic differences which do exist, there appears to be a basic homogeneity in the life-style of Canadians from coast to coast. Although the tempo of life may differ between the smaller and larger urban centres, and between urban and rural settings, the greatest variations occur as much between occupational groupings as between separate areas of the country. The degree of uniformity that exists among regions is due to the youthfulness of Canada; to the relative mobility of individuals; and to the increasing use of modern transportation and communications systems. However, the contrasts among regions, regarding the extent and pace of industrialization, pose problems for the policy-maker in government. What may

[8] *The Public Looks at Computer Services* (Canadian Facts Co. Ltd., 1972), p.35

well be the best policy for a highly industrialized region may not be entirely appropriate for a resource-based region, and vice-versa. The perennial Canadian problem of ensuring adequate regional development, and, at the same time, promoting national unity and national standards, is very real.

Against this background of regional considerations, the role that computer/communications plays now, and that it is likely to play in the future, has not been the subject of much public discussion. This is probably because too little is known about the cause-and-effect relationships of computer/communications with regard to industrial development in a regional context. Some 75% of installed computers are found within Ontario and Quebec and the concentration is even more marked within the Windsor-Quebec City corridor. Furthermore, computer installations appeared to correlate well with industrialization and commercialization rather than with the distribution of population. This is supported by the fact that Ontario and Quebec possess about 64% of the population of Canada, while some 80% of Canada's manufacturing activity is located in these provinces. It is essentially this factor, perhaps more than any other, which has brought about the concentration of computer operations. The normal pattern which exists, for the most part, in a modern computer/communications system is for a computer complex to be located in a firm's head office or major manufacturing facility, with computer terminals located in branch plants, sales offices, and warehouses across the country. Thus, the extent to which head offices and major manufacturing facilities are found in the provinces of Ontario and Quebec, has a large bearing on the location of computer installations.

Given this apparently high degree of correlation between extensive computer usage and a diversified industrial and commercial base, two questions arise which are of concern, particularly to the less-developed regions of Canada:

- Will the increasing use of computer/communications technology in the future result in a greater centralization of computer facilities?
- Are computing facilities a prerequisite for new industrial development, or do they tend to follow in the wake of such development?

The factors which favour further concentration of computing facilities include: central processor economies of scale; availability of expertise; more economical and reliable data communications; and more advanced data bank management systems. Opposed to these are factors which mitigate the effects of centralization, such as: advantages of local service capabilities; less developmental time requirements; and the promise of spectacular gains in mini-computer technology. On balance, because of the pyramid structures of most organizations, it is unlikely that the pressures towards computing facility centralization will lessen. In spite of the already high concentration of computing facilities in Ontario and Quebec, the concentration might have been even greater but for some of the difficulties experienced with the operation of very large systems and the relatively high cost of data communications.

With regard to the second question, that is, whether computing facilities are a prerequisite for industrial development, no evidence has come to light which would suggest that industrial, commercial or even institutional development is being retarded due to lack of regional computer/communications facilities. Service bureau facilities, for example, are established or are accessible throughout Canada, and the service supply segment of the industry believes that there is no lack of computing capacity. The decision to locate an industrial or commercial enterprise does not at present seem to depend on the availability of and close proximity to computing facilities. There is no reason to suppose that the hardware and service supply segments do not respond to market demand as it materializes.

Any discussion of the regional aspects of computer/communications in Canada would be incomplete without reference to the more isolated installations. A surprising number of these have grown up to serve the resource industries in isolated communities. Their significance, in terms of regional development, lies in two directions: first, their existence is evidence of the computer's applicability in the resource-based industries; second, that it is possible, albeit difficult, to obtain and retain EDP personnel in such areas.

In communities like Kitimat, Flin Flon, and Sept-Iles, computers are being used not merely for such applications as payroll, inventory control, and other accounting procedures, but also for process-control, ore body measurements, seismic data processing and geological surveying, and the application of the computer has helped considerably in the functioning of the processes themselves. In addition, it has enabled the more remotely placed enterprises to maintain a semi-independent posture.

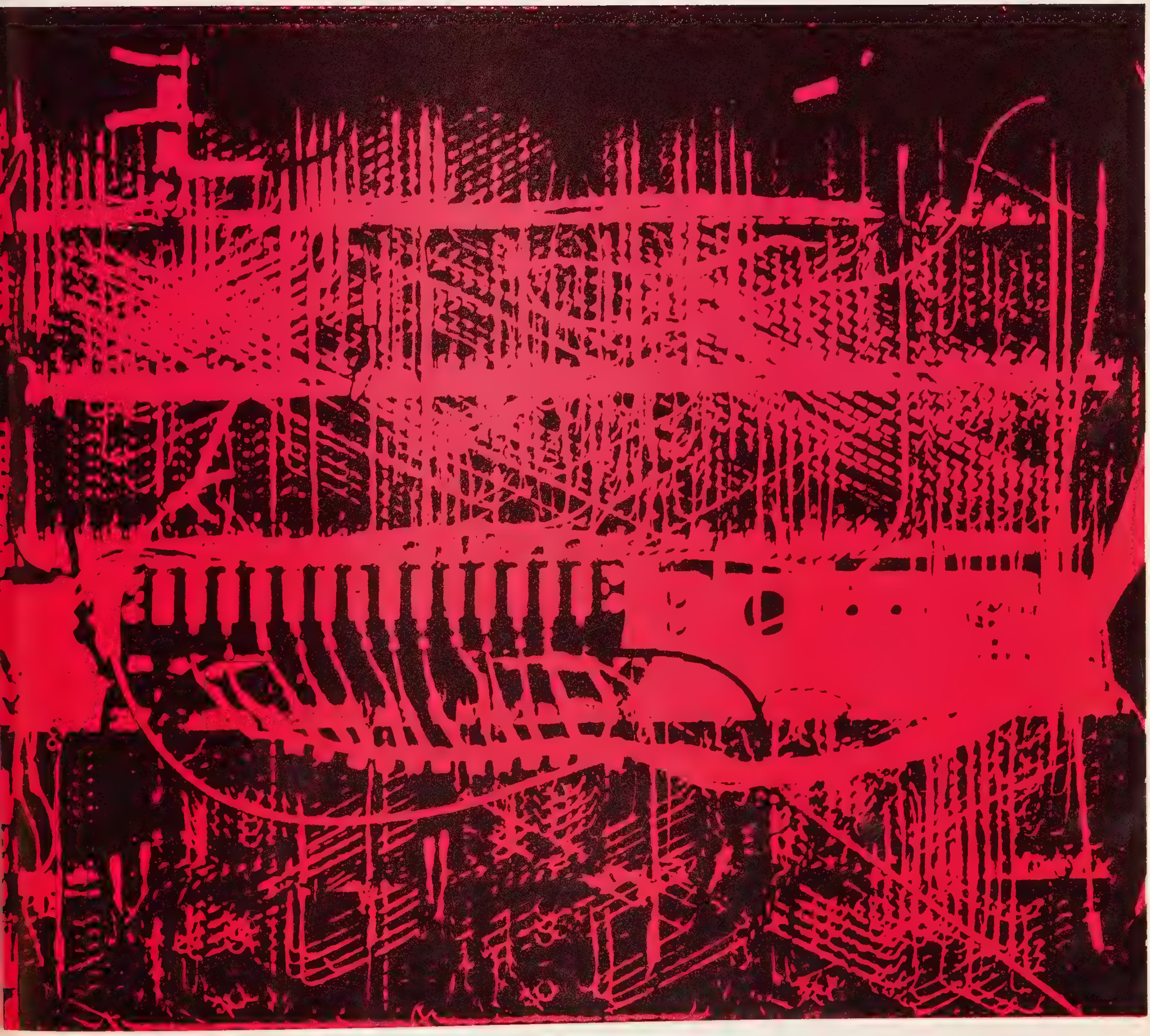
In staffing remote locations it has often been necessary to provide special inducements for managers, systems analysts, and programmers. These usually have taken the form of premium pay and fixed-term arrangements.

Remote installations of this type face an uncertain future, for it seems inevitable that, apart from specific process-control computers, much of the computing workload in the future may be transmitted through on-site terminals via communications links to central, more powerful processors. The factors that may inhibit this trend are the lack of reliable data communications facilities, the cost of these facilities, and the increased use of mini-computers.

There are no magic formulae to apply which would guarantee adequate regional development through computer/communications. The best solutions appear to lie in policies of increasing specialization, both nationally and regionally. This implies the necessity to be increasingly selective in the products and services which are developed. Unless concerted approaches towards common solutions are taken, there is the ever-present danger that particular regional needs will tend to be met from foreign sources. The fact that virtually all regions of the country are, in some measure, in closer proximity to parts of the United States than to each other does not bode well for national solutions. Foreign computer/communications services which are

readily accessible might alleviate certain regional conditions, but the ultimate result would undoubtedly be a further fragmentation of the Canadian computer/communications environment. These problems of data communications within Canada are more fully examined in Chapters IX and X.

Chapter IV
Computer/Communications Industry



The Task Force takes a broad view of the computer/communications industry. Computer/communications encompasses virtually all of the computer industry, in the sense that most computers are capable of being adapted to operate in a communications environment. On the other hand, many of the activities of the communications industry are not of direct concern at the present time, and the products and services relating to voice transmission, for example, are of interest only if they are commonly employed in computer/communications. Consequently, the industry is described as consisting of:

Those organizations which
manufacture or supply computer or
computer-related communications
goods and services.

This provides a sufficiently broad scope to examine the relationships within the industry, while excluding those products and services which are not in some way related to the computer or to communications-oriented computers.

However, the very act of definition itself creates a number of problems. It is not being suggested, for example, that a clearly-identifiable economic sector has emerged. Indeed, a number of the organizations involved may derive only a small part of their revenues from the products and services under consideration. Nevertheless, the attempt has been made to identify and include these entities and their pertinent revenues. Similarly, there are a number of specific products and services which might be included more appropriately under some other industry: products connected with avionics; with certain military uses of the computer; and with some aspects of process control. While special-purpose systems of this nature have not been entirely excluded, this Report is mainly concerned with information-processing products and services, where the industry's efforts are now being concentrated.

1. SIZE AND SCOPE

Few studies of the Canadian computer/communications industry have been published. Of these, the Trans-Canada Telephone System's analysis[1] of the Canadian market potential for computer related services is perhaps the most systematic and comprehensive. Investment dealers in particular have made reports available which appraise certain parts of the industry, but no public data base exists from which a picture of the whole can be drawn. It was therefore decided, first, to commission a study[2] of a profile of the supply side of the industry by means of in-depth interviews with a cross-section of

[1] *Computer Based Services of the Seventies* (Trans-Canada Telephone System July 1971)

[2] Forsyth George and Owen Brian Report to the Task Force on "The Canadian Computer Supply Industry Study University of Western Ontario London Ontario February 1972

supplier-organizations; and second, to establish a data base of available information in an attempt to determine the size and scope of the industry.

In pursuing the second course of action, it was initially decided to make the arbitrary and artificial division between SUPPLIERS of computer/communications goods and services, and USERS of such goods and services, with the idea that it would then be possible to correlate the supply and demand functions of the industry. In practice, the lack of published information and the complexity of the inter-relationships among the organizations involved, precluded making measurements to the desired degree of precision. Nevertheless, the attempt was made to:

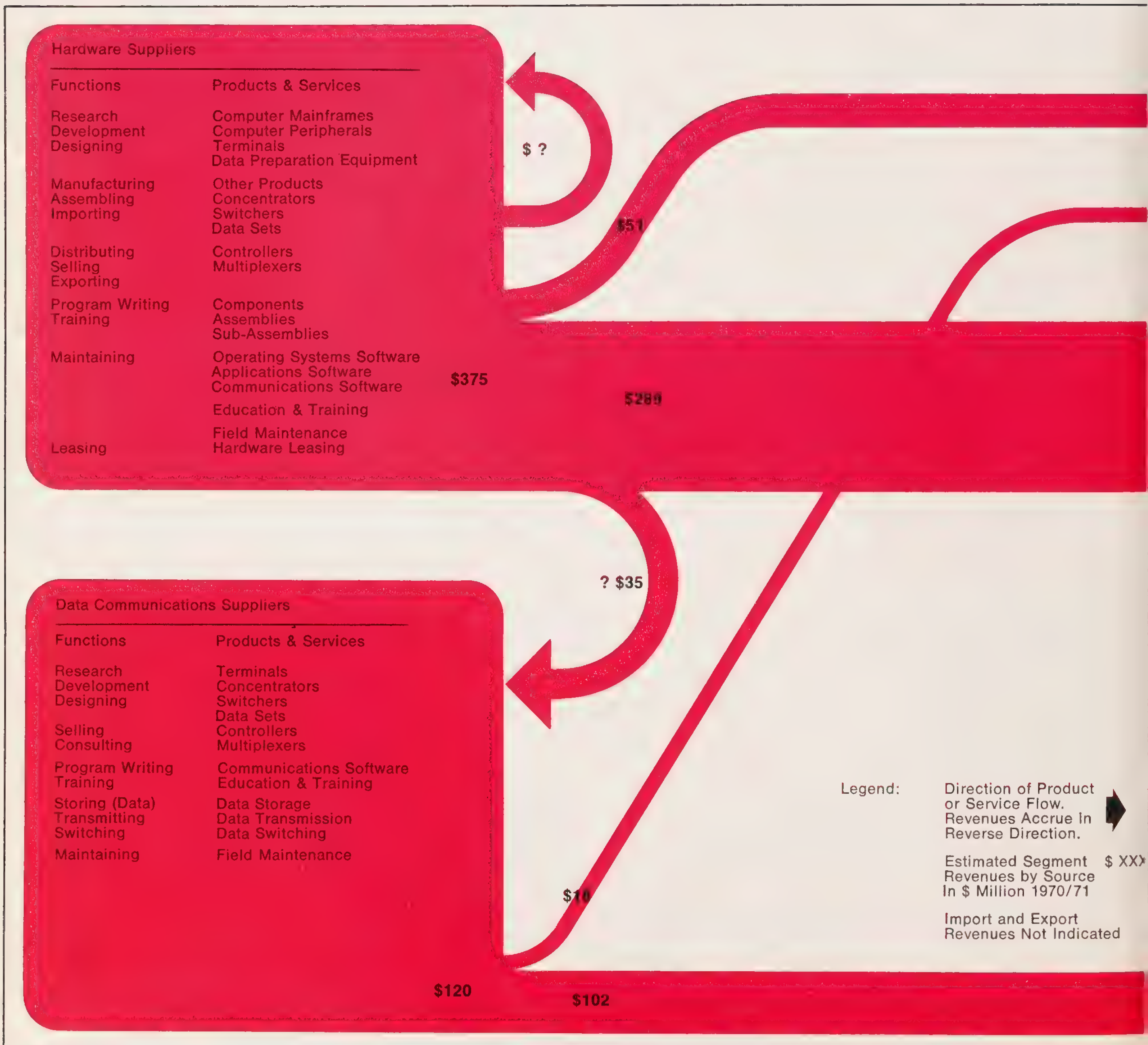
- Identify each organization which was conceivably a supplier of computer/communications goods and services;
- estimate the total revenues of the identified organizations, and that portion of the total revenues probably derived from the supply of computer/communications goods and services;
- compile other available statistics or estimates relating to the identified organizations which would be of use in the assessment process, including employment, rates of growth, and profitability.

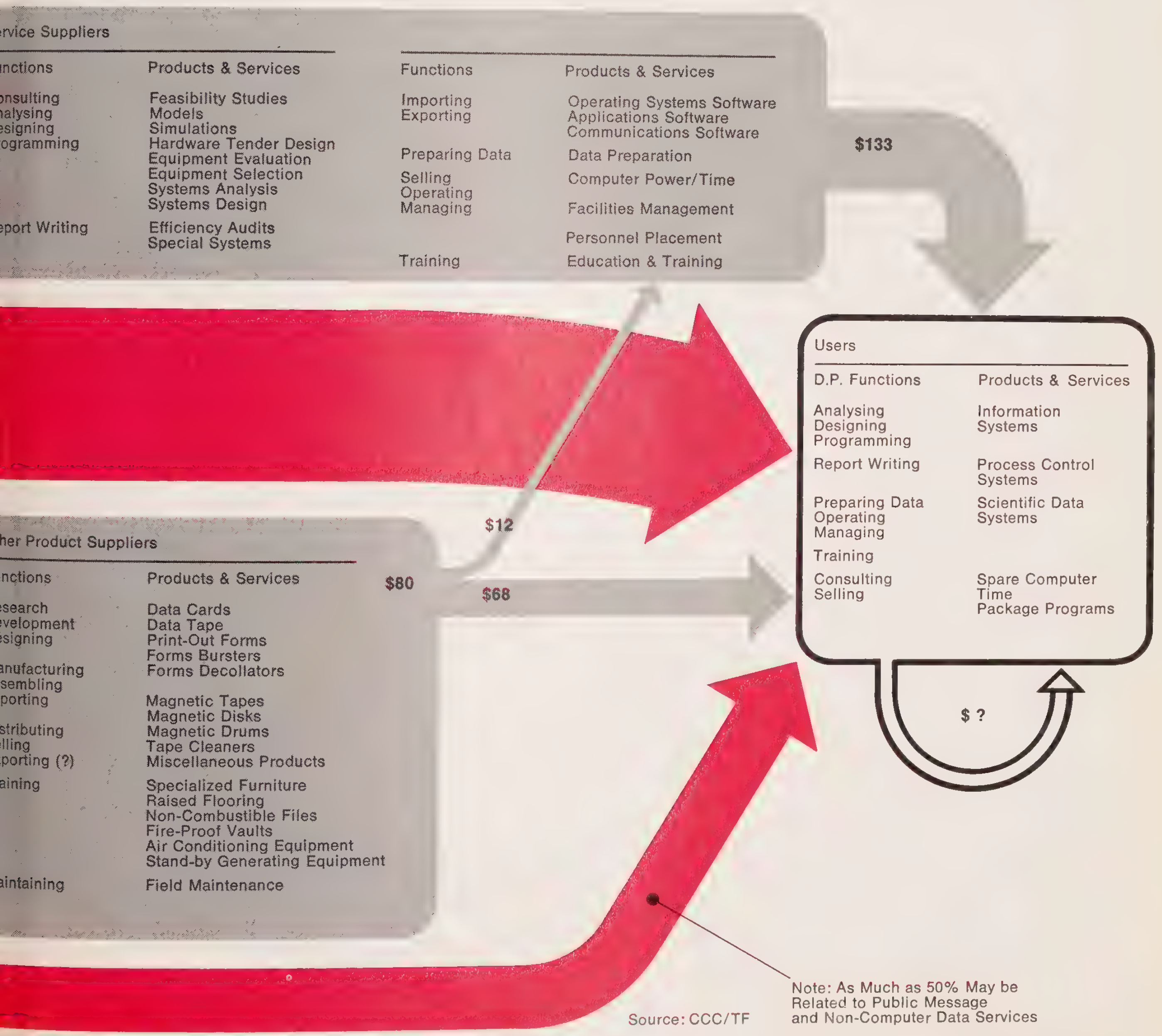
Over 500 organizations were examined in this manner, with results not inconsistent with those derived from the supply industry profile study. It became evident that there are four main supply functions in the industry, demarcated by broad types of products or services. These are:

- Hardware Supply Segment
  This segment manufactures and/or supplies computer systems and computer-related communications equipment. In Canada, in recent years, virtually all computer mainframes have been imported and manufacturing has been concentrated upon computer peripherals and data preparation equipment. Some assembling of small mainframes is now proceeding. Recent initiatives by the Department of Industry, Trade and Commerce promise to result in medium-size processor and component manufacture. The accent in this segment is on supply rather than manufacture, and there is not much evidence of research and development directed towards computer hardware. In computer-related communications equipment, the Canadian presence is much stronger. It includes the manufacture of modems, terminals, and other equipment; the development of front-end concentrators, and switching equipment employing computer technology.

- Service Supply Segment
  This segment provides a multitude of services both to computer owners and to organizations not having their own equipment. It is largely dominated by service bureaux which are considered to be the forerunners of commercial "computer utilities". Other organizations in this segment include software houses, consultants, facilities management firms, and data preparation firms, as well as organizations engaged in computer education and training and personnel placement. While lack of profitability has been a particular problem, growth rates over the past few years have continued to attract an increasing number of entrants from the ranks of users. Following a period of retrenchment in 1970-71, the entities involved are optimistic about future prospects. An expanding trade appears to be developing in the export and import of program packages. Remote computer services are exported as well as imported by means of data communications links across international borders. Most of the organizations are owned and operated by Canadians, though some of the larger entities are partially or wholly foreign-owned.

Figure 3
Product and Service Flows of
the Canadian Computer/Communications Industry

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Importing
Exporting
Operating Systems Software
Applications Software
Communications Software
Preparing Data
Data Preparation
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Computer Power/Time
Facilities Management
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Data Cards
Data Tape
Print-Out Forms
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Magnetic Disks
Magnetic Drums
Tape Cleaners
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Non-Combustible Files
Fire-Proof Vaults
Air Conditioning Equipment
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Field Maintenance
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Users
D.P. Functions
Products & Services
Analysing
Designing
Programming
Information Systems
Report Writing
Process Control Systems
Preparing Data
Operating
Managing
Scientific Data Systems
Training
Consulting
Selling
Spare Computer Time
Package Programs
$?
Note: As Much as 50% May be Related to Public Message and Non-Computer Data Services
Source: CCC/TF

• Data Communications Supply Segment
This segment provides the facilities and services for the transmission of data between computers and between computers and terminals. The suppliers comprise the telegraph and telephone companies, which have a mixture of public and private ownership. There are many hundreds of telephone companies in Canada, of which 15 account for 98% of the revenues. No more than 4% of these revenues[3] are derived from the transmission of data and the rental of data equipment. Much of the data transmission in Canada is through private-line facilities leased from the carriers by individual users. This segment is now beginning to play a more active role in the industry as the merging of the technologies of computers and communications becomes more pronounced. At the same time, pressures on the carriers for more economical and reliable data (as opposed to voice) transmission facilities have been growing.

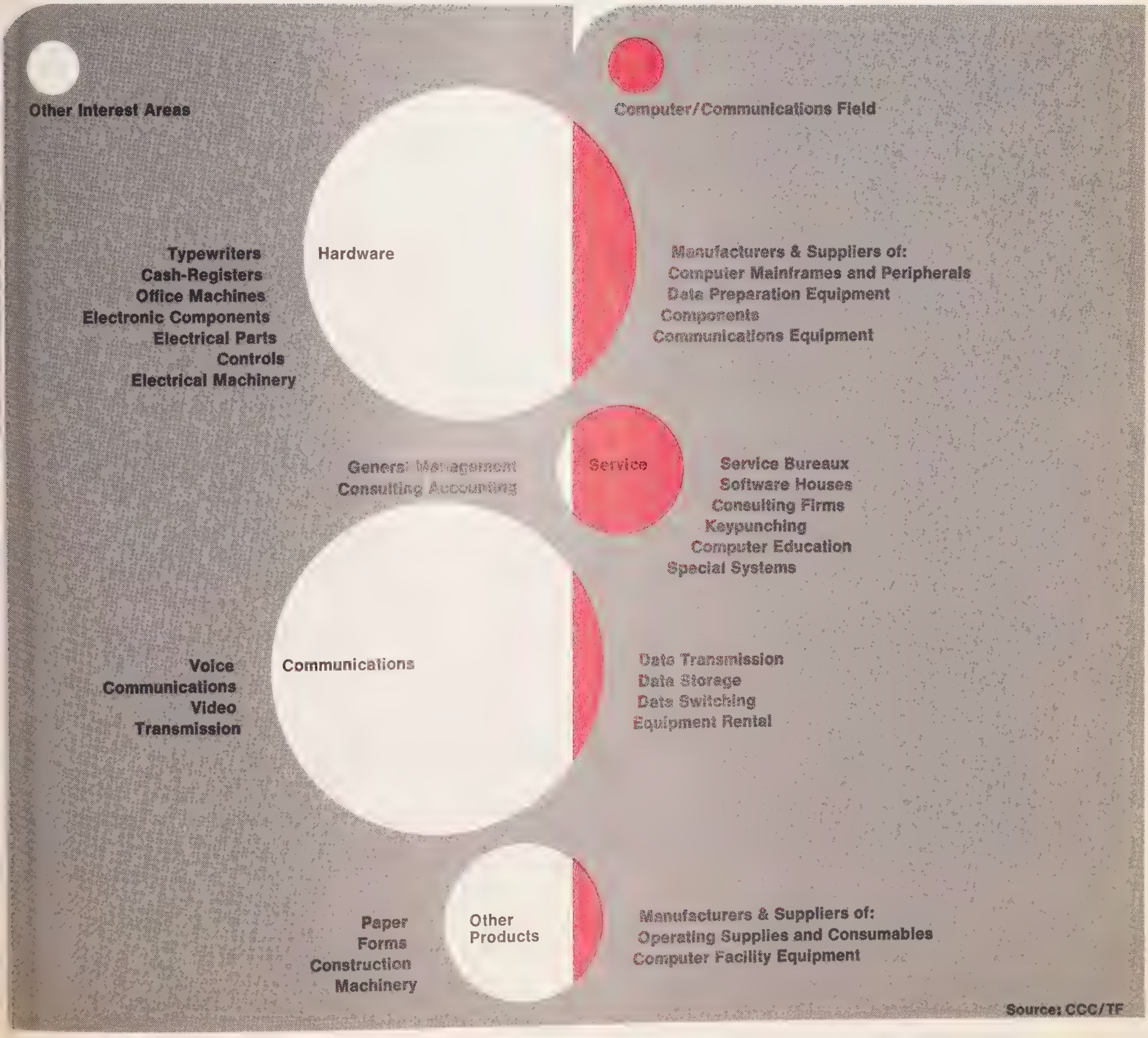
• Other Product Supply Segment
The function of this segment is to supply those products which the computer has engendered during the course of its evolution. In general, they may be described as important adjuncts without which computer systems could not operate. A convenient classification suggests two types of product: first, operating supplies and consumables (magnetic tapes, punch cards, etc.); second, computer facility equipment which provides or enhances the environment in which computer systems operate (raised flooring, stand-by generating equipment, etc.). The value of these products has now reached significant proportions, and Canadian organizations are well represented.

Figure 3 illustrates the functions, products and services of each of the four segments as they pertain to the computer/communications industry. It illustrates the magnitude of their relationship with the user and with other segment suppliers. An important point to note is that some supply organizations are involved extensively in as many as three of the four supply segments, and are frequently prolific users of computers as well. Figure 4 illustrates the degree of involvement in the computer/communications industry by the organizations within the four segments. Some of their more traditional products and services are shown, to indicate the difficulties of segregating pertinent revenues from the total and to suggest that, although involvement by some segments is marginal, an increased involvement can be expected depending upon the extent to which the industry provides higher growth rates than those supplied by their other interests.

In summary, total industry revenues in 1970-71 are estimated to be $592 million. This is after taking into account trade among suppliers shown in Figure 3, and deducting estimated inter-segment trade revenues. Total industry

[3] Greener fields ahead? — Bell merges computer communications into new division *Financial Times of Canada* Vol 59 No 42 March 8 1971, p 16 R C Scrivener President of Bell Canada was quoted in this publication as stating that data communications revenues accounted for 3% of Bell's business In private communications to the Task Force and in subsequent public presentations, TCTS has stated that the applicable figure for TCTS member companies is "between 3 and 4% of total revenues

igure 4
upplier Participation
n Computer/
ommunications



employment attributable to computer/communications goods and services is estimated at 39,900. Segment revenues, employment, and industry totals are indicated in Table 1.

It is now necessary to consider the position of users within this industrial context. One of the unexpected factors that has emerged from the Task Force study is the recognition of the growing number of users who are also suppliers or potential suppliers of computer-based services. It has long been recognized that some users have sold spare computing capacity in an effort to offset in-house data processing costs, but more recently a trend has become apparent among large-scale users to transfer their expertise to the marketplace by offering computer-based services as regular, marketable commodities. The reasons for this development are explored more fully in the profile study and in Part C of this Report, but, in the present context, it emphasizes the artificiality of the distinction between users and suppliers. As a consequence, there are some legitimate grounds for suggesting that, in order to gain a more complete appreciation of the size of the industry, it may be desirable to include in the total those user-expenditures which are not a revenue to suppliers. These are mainly the salaries and wages paid to user-personnel directly concerned with computer/communications, and they amount currently to an estimated net $345 million. A further rationale has been suggested in which the computer is regarded as essentially a complex system of "dead" machinery, which is not brought "alive" until the necessary programs have been written, and which is constantly "rejuvenated" by changes to those programs. The rationale implies that data processing personnel are somewhat apart from all other user-personnel, and that they should be considered, therefore, as part of the computer/communications industry. If one accepts either of these interpretations, then the total "value" of the industry in 1970-71 amounted to $937 million ($592 million supplier revenues plus user salaries and wages at $345 million).

2. USERS OF EQUIPMENT AND SERVICES

It is also useful to examine the position of users from the viewpoint that they represent, in part, the demand function for equipment and services. (The term "user" implies use of a computer from whatever source, be it in-house, through a service bureau, or from a casual supplier).

In reality, only users of equipment are included here, although they constitute probably the major portion of service users as well. Information on the universe of users in Canada is derived from the annual computer census, published by the Canadian Information Processing Society(CIPS). The information contained in these documents is provided voluntarily by users and figures relating to equipment rental or purchase prices are retained on a confidential basis by the CIPS Census Committee. It was necessary, therefore, to obtain the raw data, apply average values to each installed computer system in terms of annual rental equivalents and to use these and other data in a variety of ways in order to extract the inferences, conclusions and forecasts presented below.

Table 1
Suppliers of Equipment and Services
Annual Revenues and Employment: 1970-71

Segment	Number of Organizations	Estimated Total Revenues ($ Million)	Estimated Revenues Attributable to Computer/Communications ($ Million)	Estimated Number Employed in Computer/Communications
Hardware	156	1,850	375	21,000
Service	258	145	133	7,500
[illegible]	15	1,650	120	6,400
Other Products	57	700	80	5,000
Sub-Totals	486	4,345	708	39,900
Less: Inter-Segment Trade	—	—	116	—
Totals	486	4,345	592	39,900

Explanatory Notes:

1. For the most part, the estimates shown represent median values, the ranges of which have been omitted for purposes of brevity.
2. The employment estimates include both full and part-time personnel.
3. The communications revenues in this industry include public message and non-computer data revenues.

Source: CCC/TF

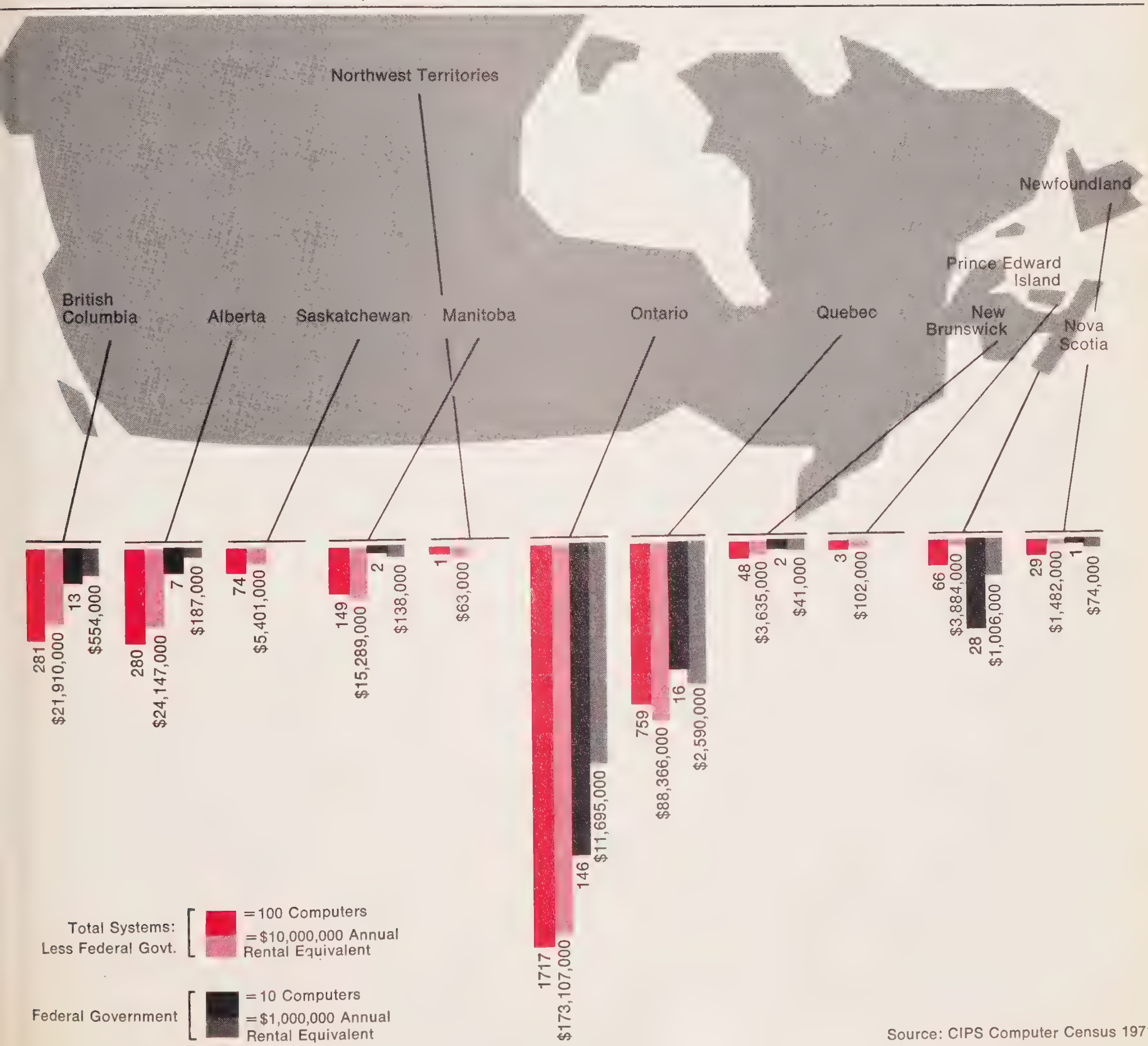
The 1971 census data indicated that there were approximately 3600 computers[4] installed in Canada as of the end of May 1971. A year earlier, 2700 computers were reported as installed, indicating a net increase of 900 systems between 1970 and 1971, or 33 1/3%. Because of the voluntary nature of the reporting, persons connected with the industry have suggested that the 1970 census was understated by as much as 15%, while the 1971 census understatement is considered to be less than 5%. Thus, the net increase in the number of computer systems installed in Canada between May 1970 and May 1971 was probably closer to 20%. While this represents the most recent estimate of growth, numbers of systems can be misleading because they encompass such a wide variety of computers. The counting of a mini-computer at a rental of less than $1000 per month is by no means equivalent to the counting of a super-large computer at over $50,000 per month, yet both appear in many tabulations as numbers in a common total. The value of a system, or annual rental equivalent, is perhaps the best yardstick that can be employed. Using this measure, the value of installed computer systems in Canada grew from about $300 million in 1970, to about $354 million in 1971, an increase of 18%.

There are many possible ways to present the total picture of Canadian usage, but perhaps three methods, illustrated in Figures 5, 6, and 7, are sufficient to describe the essential points. Figure 5 shows the geographic distribution of computer systems by province, with federal government departments shown separately. Not unexpectedly, the provinces of Ontario and Quebec account for some 75% of the total installed value. But the concentration is even more marked when it is considered that the great majority of these systems are to be found in the Windsor-Ottawa-Quebec City corridor. The preponderance of usage in Ontario is further accentuated by the bulk of the federal government systems being located in the national capital. In general, the geographic distribution of computer systems appears to be a correlate of industrialization and commercialization, rather than bearing a direct relationship to population distribution.

Figure 6 illustrates the number and value of computer systems installed, by economic or institutional sector. To some degree, it emphasizes the diversity of users and the universality of the computer, at least at the organizational level. In both value and number, the public sector accounts for just over one-third of the total systems, and appears to be gaining a greater share, while the private sector accounts for the remainder. The diagrams in Figure 6 illustrate also those sectors which tend to operate larger-than-average systems, as well as the reverse. Thus, the service bureau sector accounts for 15.3% of the value of installed systems, but only 8.6% of the number, whereas the manufacturing sector has 17.6% of the value and 22.0% of the number. This situation would not be substantially affected by the transfer of

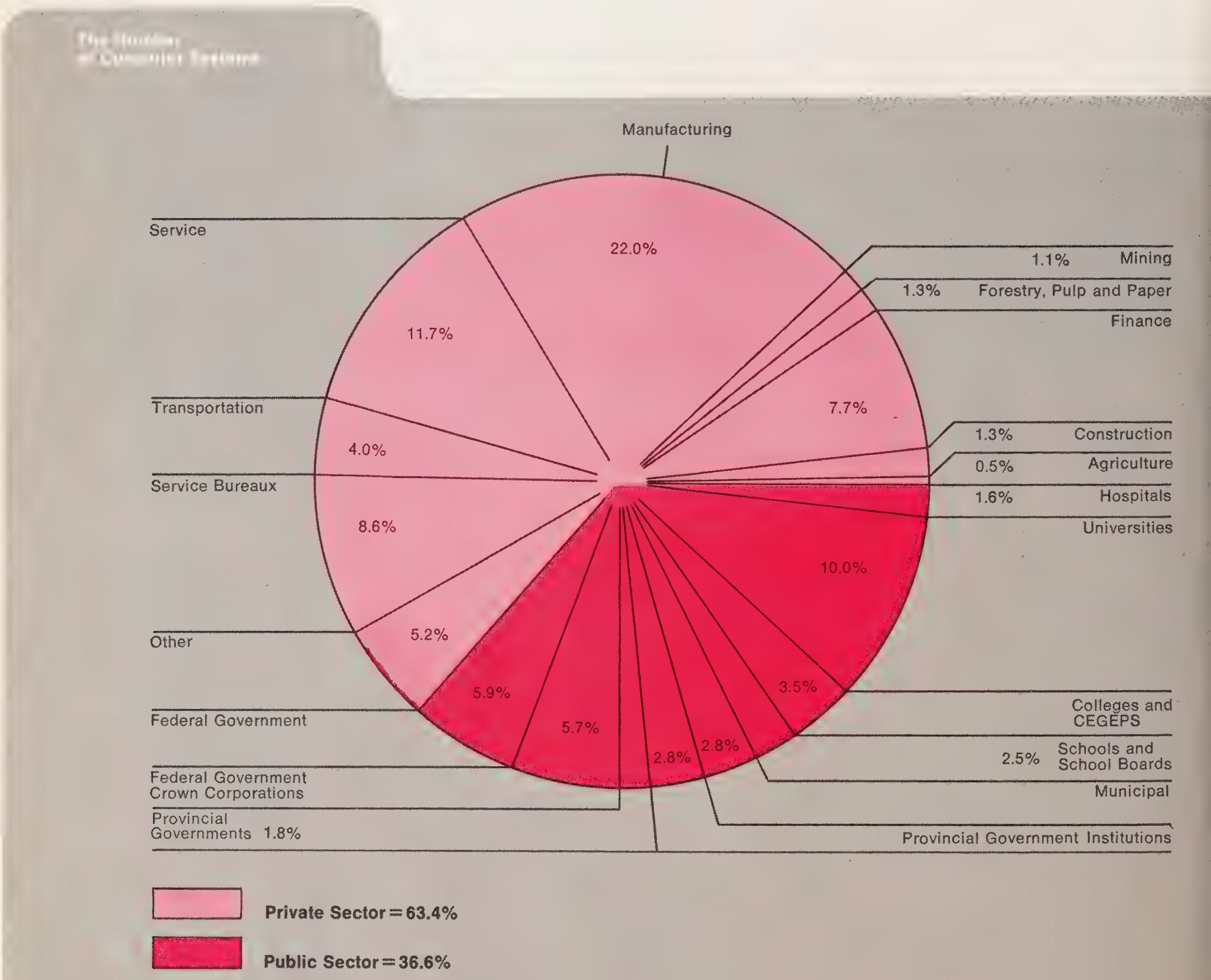
[4] The data cards supplied to the Task Force by CIPS recorded 3622 computer systems installed in Canada as at May 1971. This figure differs from that of 3548 systems published in the 1971 census, and may be the result of more recent information.

gure 5
eographic Distribution of Computers
 Number and Annual Rental Equivalent: May 1971



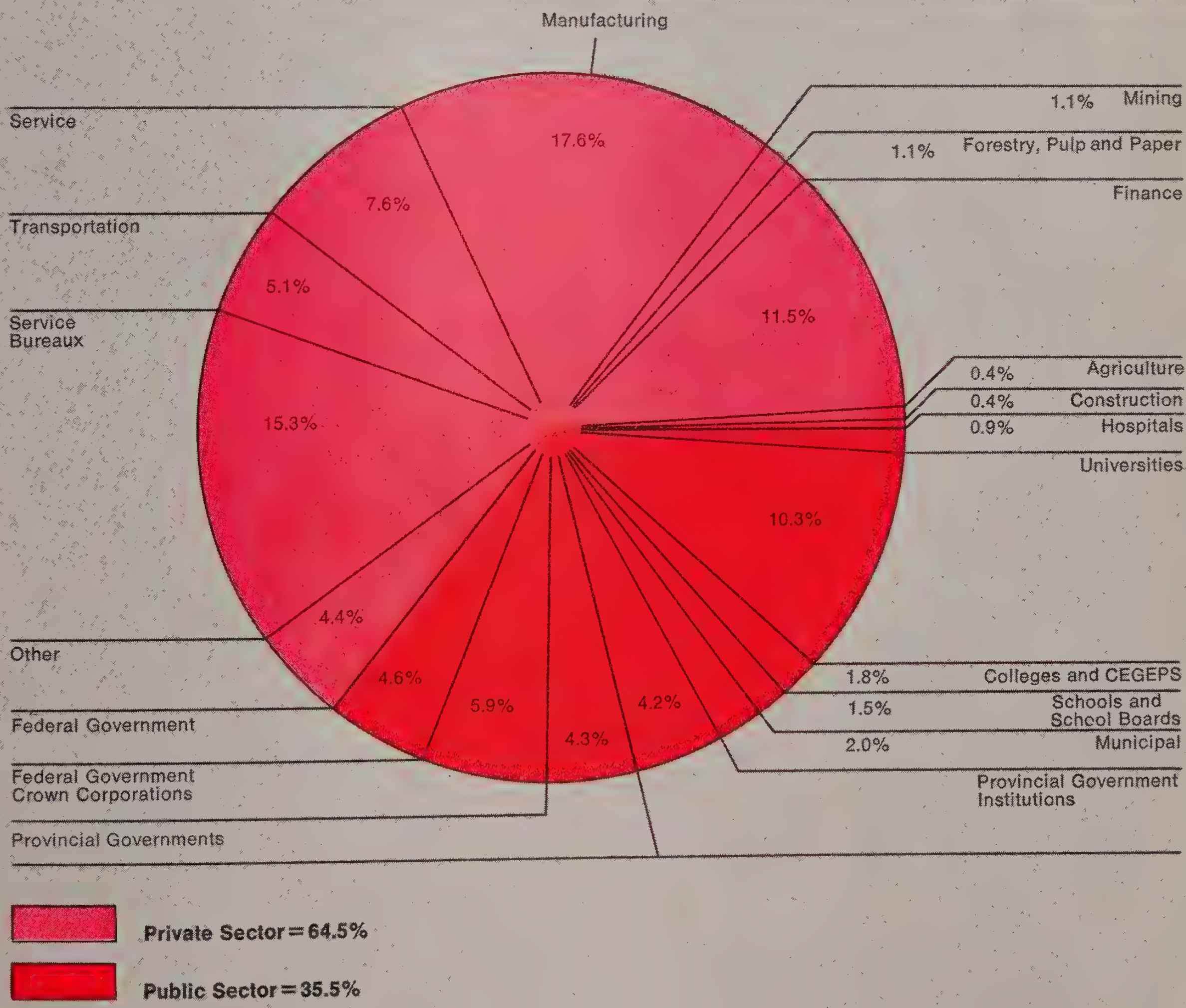
Source: CIPS Computer Census 1971

Figure 6
The Relative Distribution of the Number and Value of Computers
by Economic and Institutional Sector in Service in Canada: May 1971



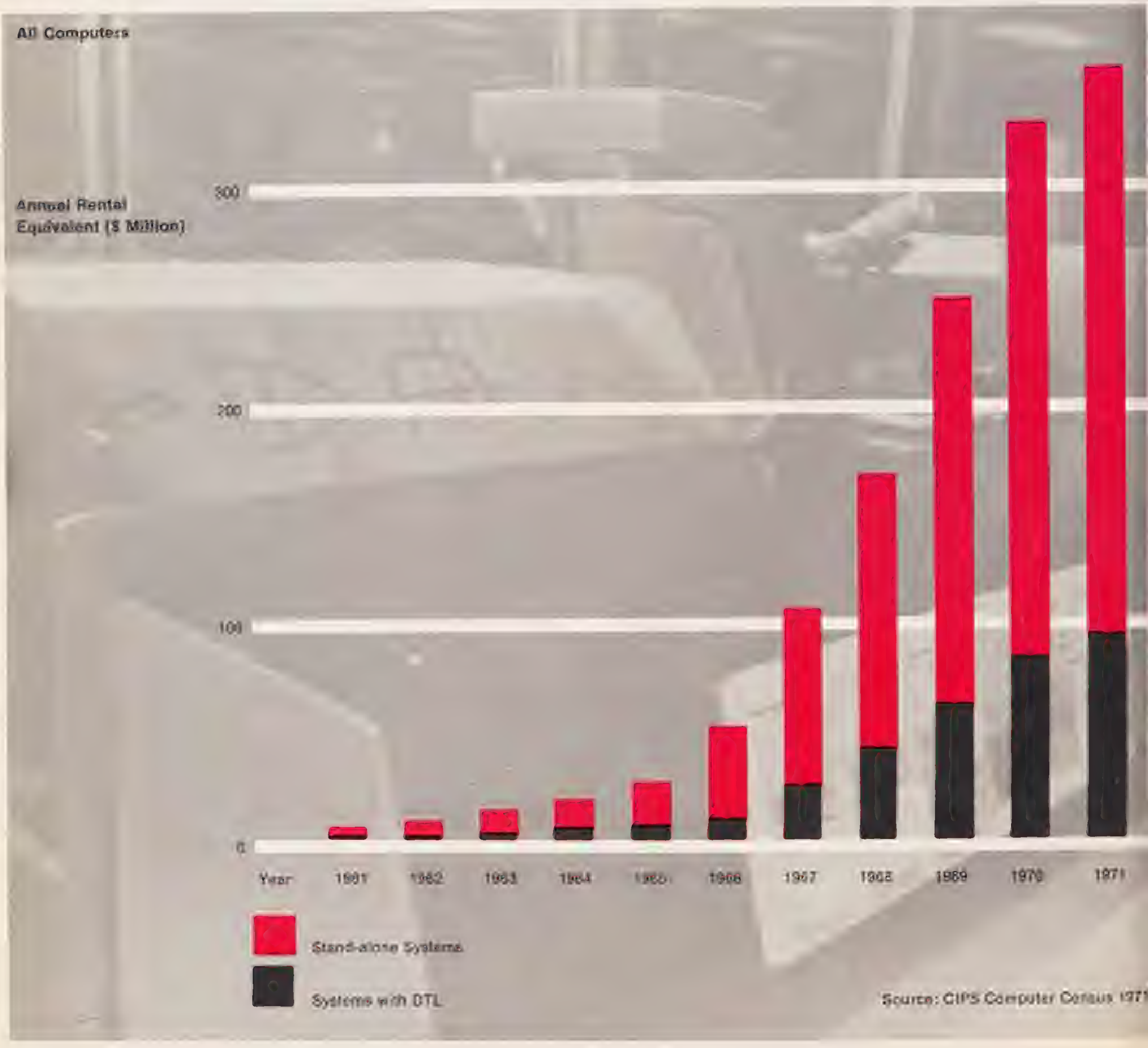
Source: Canadian Computer Census 1971, Canadian Information Processing Society

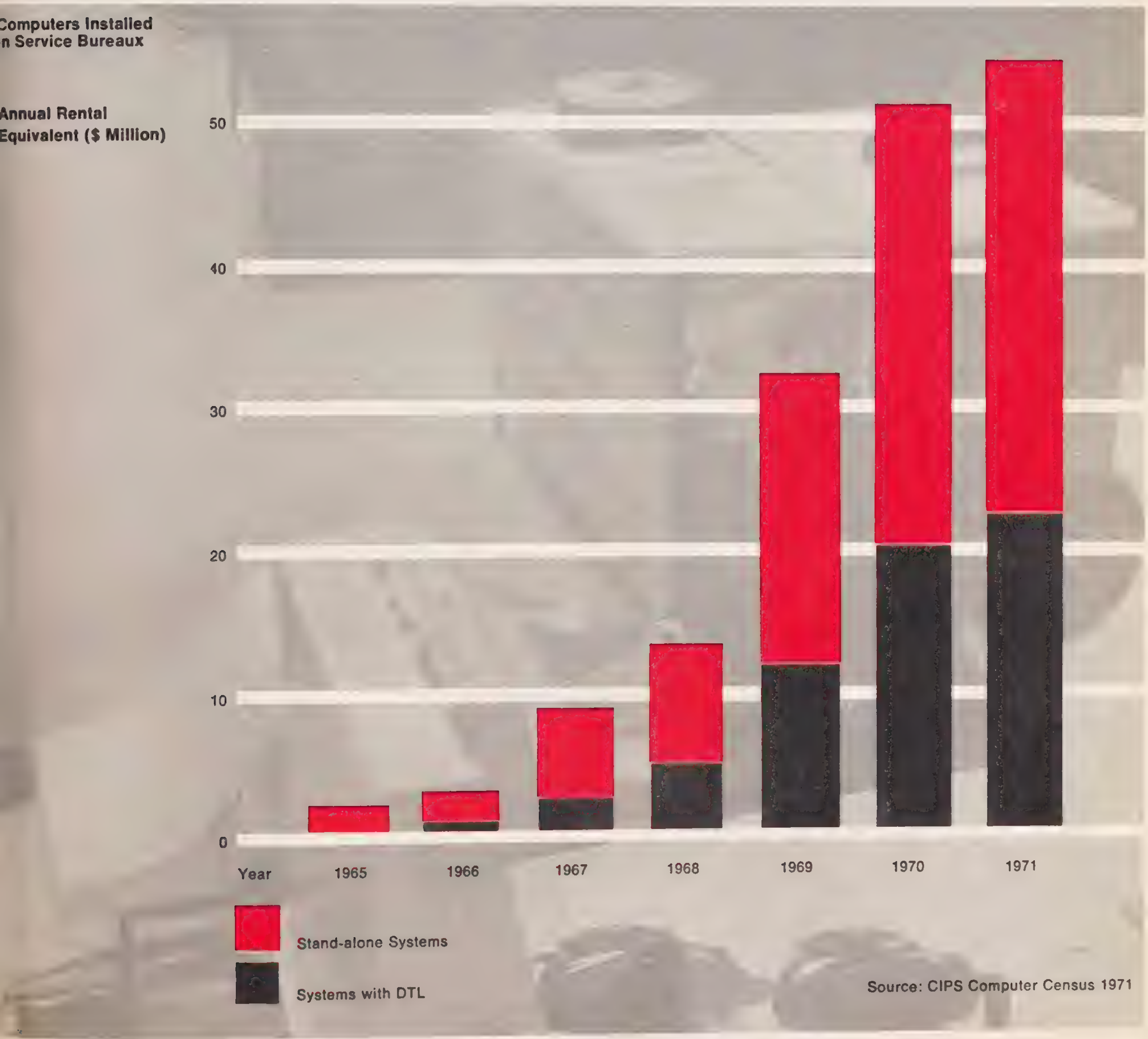
The Users of Computer Systems



Source: Canadian Computer Census'1971, Canadian Information Processing Society

Figure 7
The Value of Computers by Year of Installation in Service: May 1971





Computers Installed
in Service Bureaux
Annual Rental
Equivalent ($ Million)
50
40
30
20
10
0
Year
1965
1966
1967
1968
1969
1970
1971
Stand-alone Systems
Systems with DTL
Source: CIPS Computer Census 1971

entities from institutional to economic sectors, *e.g.*, from federal Crown Corporations to transportation, although the latter would, of course, gain a larger share.

It is informative also to look at those users which utilize data transmission facilities in conjunction with their computer systems. The CIPS computer census identifies these systems with the notation "DTL" (Data Transmission Link), which is described by CIPS as "computer to computer transmission". Figure 7 illustrates two dimensions of this use: first, the value of all systems in service in 1971, cumulatively by year of installation, showing separately stand-alone systems, and systems with DTL; second, service bureau systems in a similar manner. These diagrams depict the extent to which computer systems have become communications-oriented in total, and also in that segment of user-suppliers where the most prolific use of communications might be expected, that is, among the service bureaux. This is indeed confirmed by the percentage of communications usage: 13% and 27% respectively. One point should be noted, however, for the representations are not reflections of trends; rather they signify the age of installed computer systems without indicating the age of the attached communications capability. For example, a system reported as installed in 1965 may not have had a communications capability added until 1969. Thus, while the true trends may be difficult to trace, there is no doubt that more of the recently-installed systems tend to be equipped with a data communications capability, which again emphasizes the merging of the two technologies.

3. PROSPECTS

In Chapter II, it was pointed out that the bulk of the potential market for computer/communications goods and services remains untapped. It was noted also that the costs of technology for this market are still considered prohibitive. There are many questions which arise, therefore, when considering the prospects for the industry in this decade: questions relating primarily to whether the potential demand for services to the home and to small businesses will materialize, and if it does, what methods of delivery will be involved, and when the actual demand will arise.

Many attempts have been made in an effort to provide some answers, including the use of Delphi techniques.[5] Most of them predict that these developments will take place, but differ in their assessments as to the timing of their introduction and widespread use. A few studies, based on the limited number of experiments now in existence, suggest that some of these advances, will become a reality by 1975. Most of the others, however, do not see these developments occurring until at least 1980, with wide implementation extending to the year 2000 and beyond. The Task Force,

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[5] *Communications, Computers and Canada* (Trans-Canada Telephone System, November, 1971, revised December 1971)

which is concerned primarily with developments in this decade, takes the view that widespread use of computers in, or connected to, the home is most unlikely before 1980. Small businesses, however, are much more likely to benefit from computer/ communications technology, particularly after 1975. In each instance, cost will be the key factor, although reliability and quality of service will be of great importance as well.

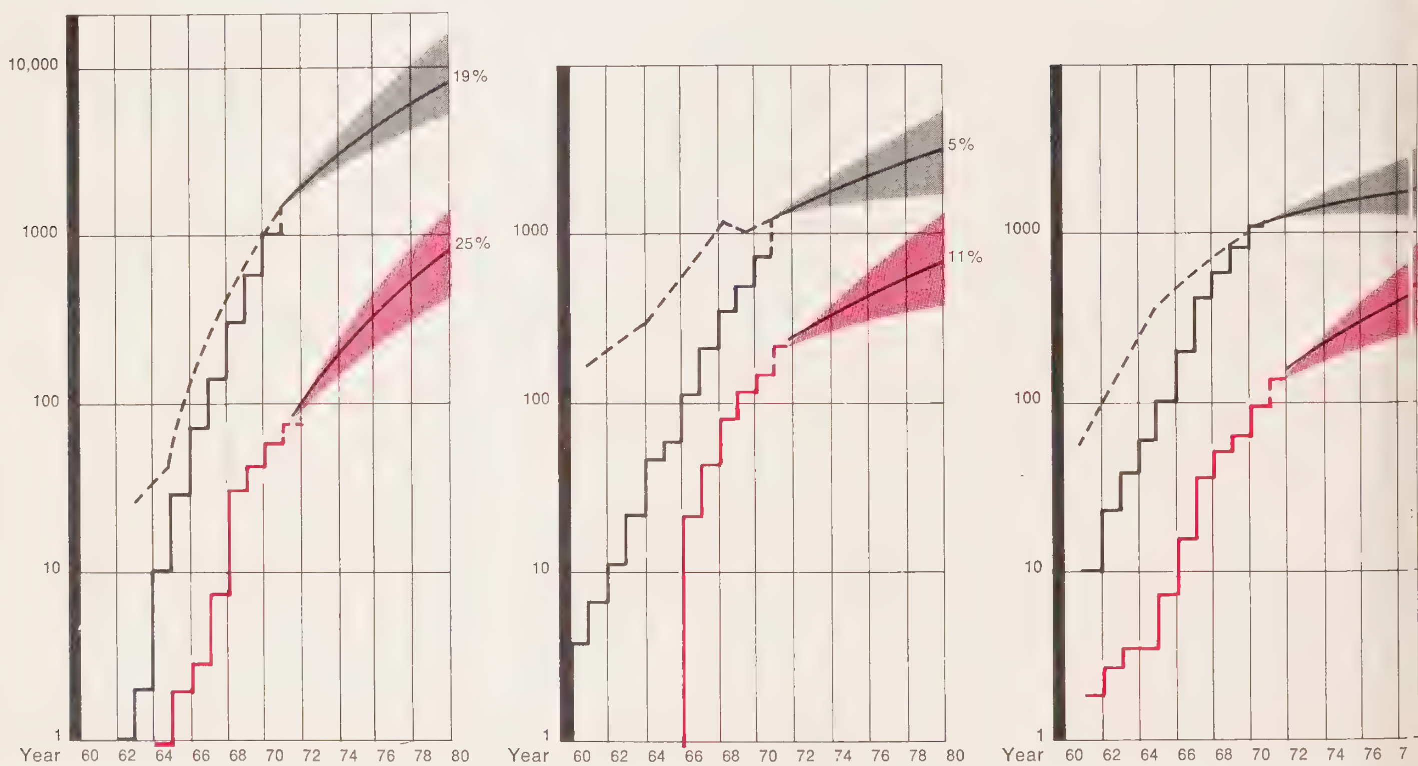
Where computing equipment is concerned, it is possible to take a more conventional approach to forecasting future requirements. Here, the problem is to measure the probable demand which will be generated by present users, as well as by those who would be most likely to join their ranks in the period under review. The basic method employed by the Task Force has been to extrapolate the trends that are evident in the CIPS computer census; to make some judgments about the trends in the light of experience; and to impute future revenue values to the industry segments. A prerequisite was to classify currently installed computers into arbitrary categories which would allow normal trend extrapolations to be undertaken. Additionally, it was necessary to infer past trends by category from previous census figures. The results of these extrapolations appear in Figure 8, which indicates that Canada should have a computer population of between 9,000 and 24,500 computers in 1980, with a probable quantity of about 15,000 systems in service in that year. Figure 9 summarizes the most likely expectations of both quantities and values and their attendant growth-rates.

The dangers of relying on trend extrapolations are well recognized. For this reason, the comments which follow are intended to highlight, clarify, and modify the forecast as presented:

- Growth appears most evident in the high- and low-end categories of computers. Each end of the capacity scale appears to be encroaching on the ground occupied by medium-sized systems, a fact which is consistent with recently published information[6] relating to unfilled orders for computers compared with those installed.
- The market saturation effects for small, large, and super-large systems are uncertain. While there is every expectation that a healthy replacement market will exist, coupled with a movement towards increased capacity, and a greater number of peripheral devices, this will not increase the total inventory of systems If the growth projections are to be realized, the demand must originate from one or more of three sources: those organizations requiring second, third, or more systems; those organizations which will have grown sufficiently to enable them to enter the market for the first time; and those organizations which, in spite of already being of sufficient size, have not thus far become users of in-house equipment.

[6] *EDP Industry Report* (International Data Corporation Newtonville. Mass August 31. 1971. and October 19. 1971)

Figure 8
Estimated Number of Computer Systems in Service by Size by
(i) All Systems, Including Year of Installation and Growth-Trends, and
(ii) Data Transmission Capability: 1960-1980



Mini-Computer Systems
Annual Rental
Equivalent $0 - 12000

Small Computer Systems
Annual Rental
Equivalent $12 - 60 Thousand

Medium Computer Systems
Annual Rental
Equivalent $60 - 240 Thousand

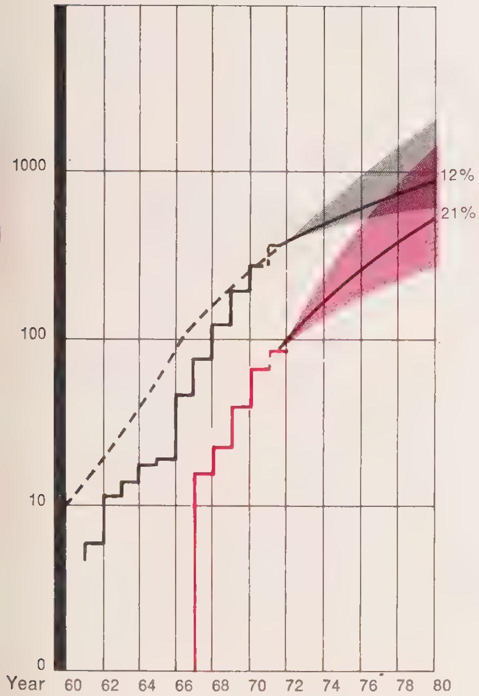
Legend

The Number of Computer Systems by Year of Installation in Service at May 1971

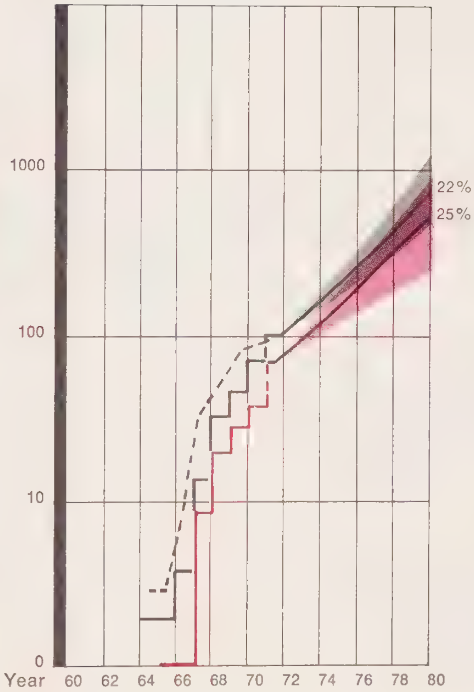
The Number of Computer Systems with DTL by Year of Installation in Service at May 1971

The Actual Number of Computers in Service in each Year 1960 to 1971

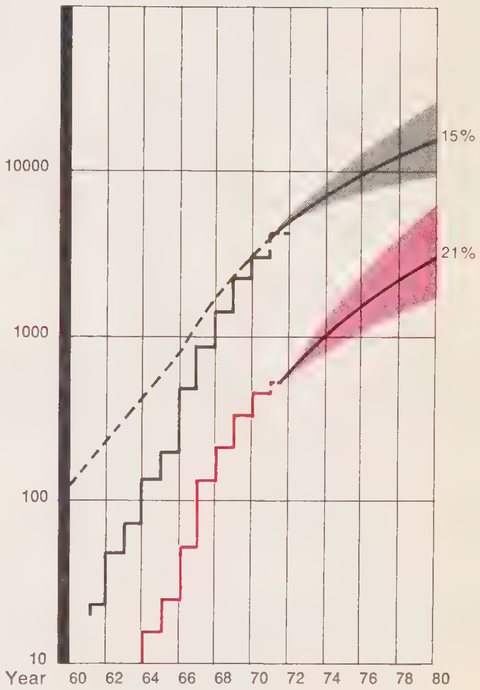
Upper and Lower Limits of the Projected Number of Compu in Service 1971 to 1980



Large Computer Systems
Annual Rental
Equivalent $240 - 600 Thousand



Super-Large Computer Systems
Annual Rental
Equivalent over $600 Thousand



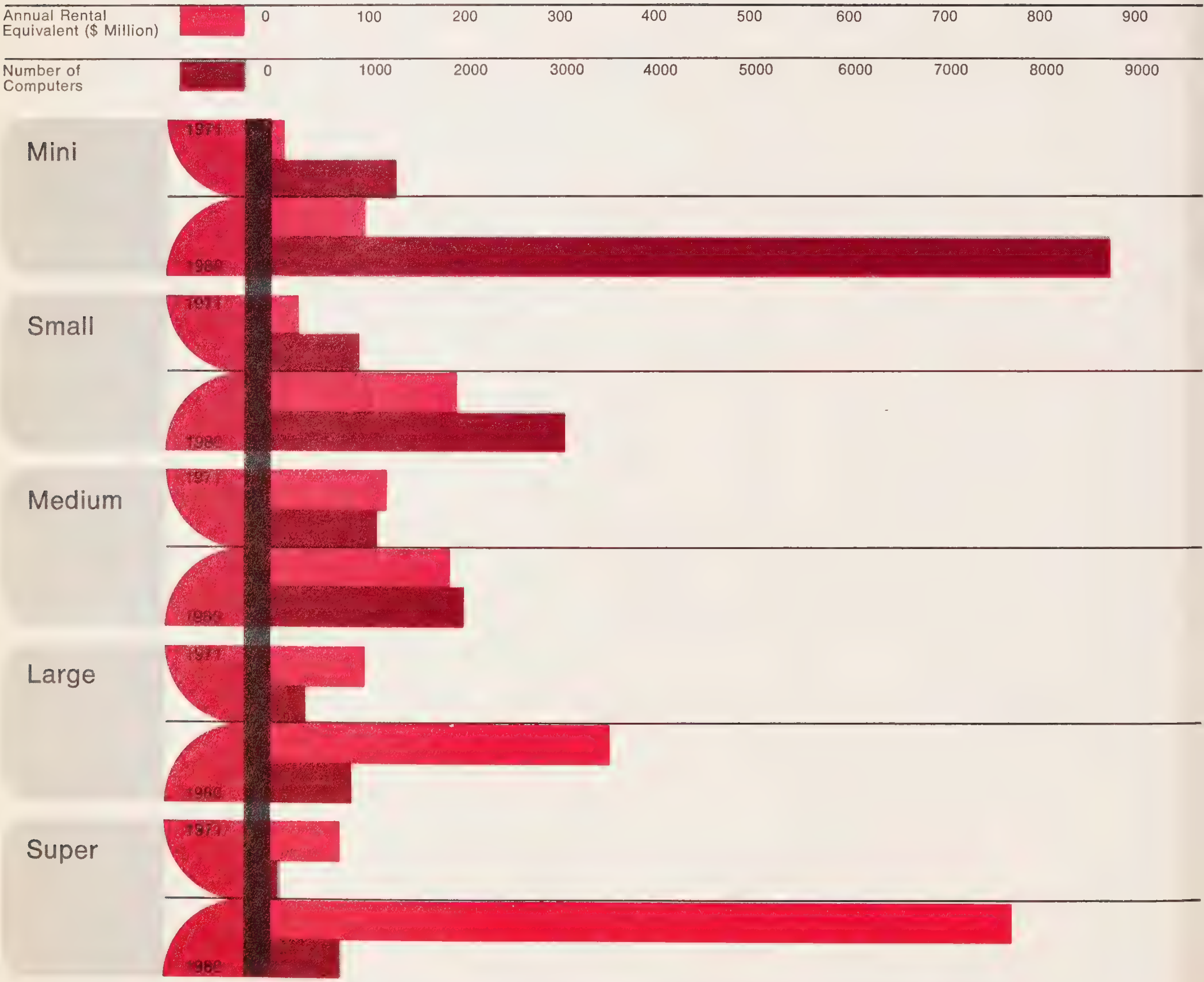
The Total Number of Computer Systems

per and Lower Limits of
Projected Number of Computers
h DTL in Service 1971 to 1980

Nota Bene: Percentages Shown Indicate Compound Annual Median Growth-Rate

Source: CIPS Canadian Computer Census 1971 Projections CCC/TF

Figure 9
The Number of Computer Systems in Service
in 1971 and Projected for 1980



Source: CIPS Computer Census 197
Projections CCC/TF

- As a corollary to the market saturation effects, there are particular doubts about the growth of computer usage in the number of super-large systems to the extent predicted. It requires a very big organization to support annual expenditures approaching $2,000,000 for data processing activities, which is the basic amount required to operate such systems. There do not appear to be enough entities, either existing or being formed, which could support such expenditures in Canada. On the other hand, if economies of scale are seen to be emerging, new consortia, and mergers of government departmental systems, could be sufficiently numerous to attain the predicted growth.

- Services of the types provided by service bureaux both complement and compete with in-house systems. The nature of their impact on in-house installations is still emerging. It is not unusual for the very largest organizations to avail themselves of elaborate in-house systems, while also using service bureau facilities. It would seem probable that general-purpose computing services tend to reduce the number of in-house systems, while special-purpose services are much more likely to complement in-house installations. The increasing specialization which is becoming evident among service bureaux suggests therefore that these suppliers are unlikely to have a significant impact on the numbers of in-house computers and, therefore, on the total number of computers predicted.

These comments illustrate a few of the factors that may exert an influence on the forecast of computer systems which will probably be installed by 1980. Undoubtedly, technological innovations, the general economic climate, and possibly other influences could also affect the forecast substantially.

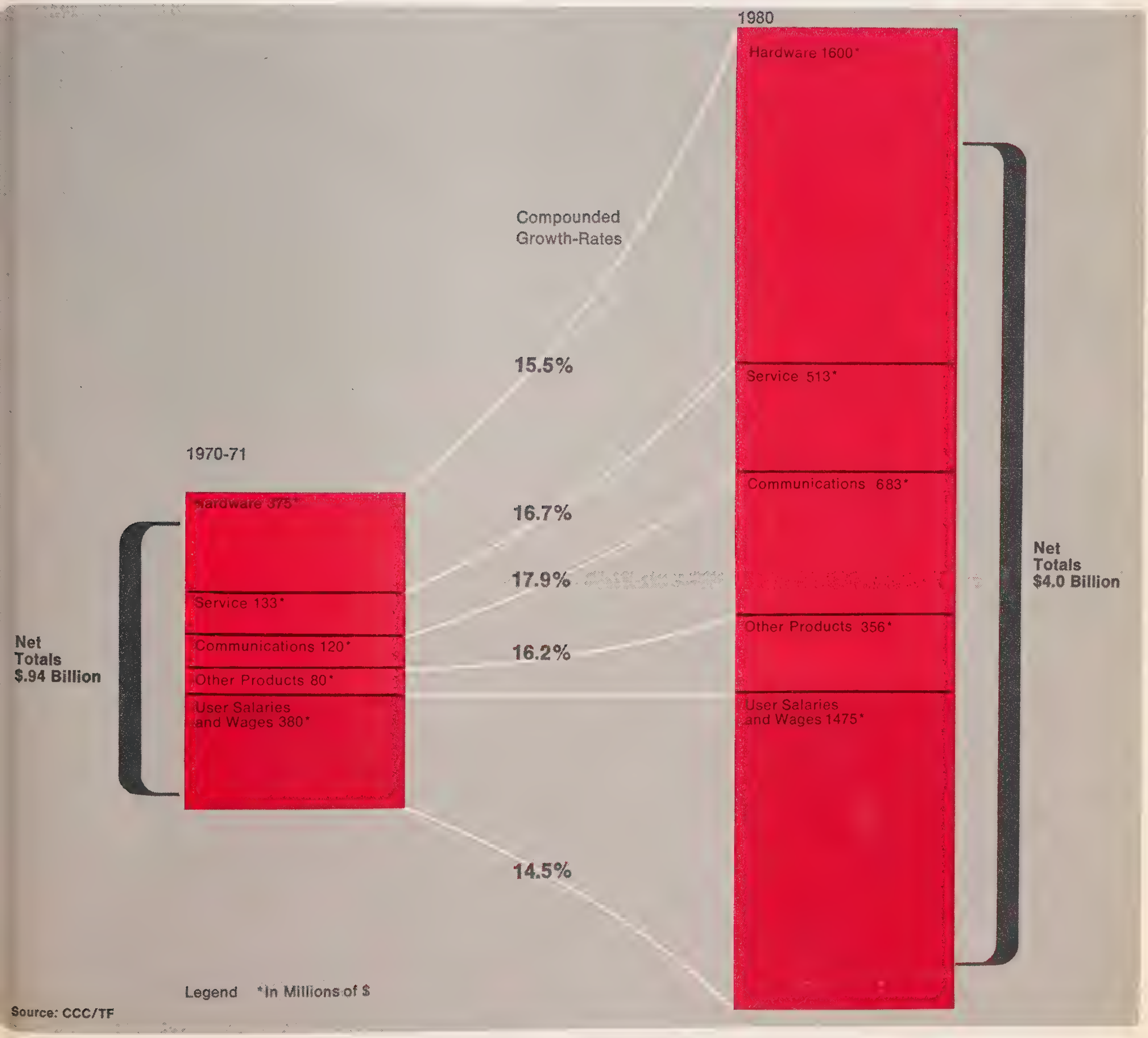
Thus far, the discussion has centred upon the prospects for computer systems, without referring to their anticipated communications capabilities. The difficulty of discerning trends from computers equipped in this manner has been touched upon earlier. Nevertheless, the attempt has been made to estimate growth-rates for DTL computers within each category, by making assumptions concerning recently-installed DTL systems versus total DTL systems. The imputed trend lines have been superimposed on the diagrams in Figure 8. These suggest that communications-oriented computers have an over-all growth-rate approximating 21%, in contrast to a growth-rate of 15% for all computer systems. By this reasoning, about one-fifth of all computers in 1980 will be communications-oriented, in contrast to about one-eighth in 1971. These low figures become more understandable, however, when it is recognized that they represent about 55% and 26% respectively of the installed rental equivalent value of computers.

These statistics do not by any means reflect the whole story of computer/communications. Within this activity a growing number of devices which complement the computer have come upon the scene. The particular reference here is to computer terminals. A recent estimate suggests that there are over 500 models of terminals available, but this information does not assist in either defining or quantifying these devices. Their characteristics range all the way from a sophisticated input-output station, in which a small computer may be involved, to a Touch-Tone telephone set which may be used to interrogate a computer file and to receive a response in voice answer-back form. The fact that a very large computer, operated in conjunction with appropriate concentrating facilities, can manage hundreds of terminals suggests that these devices, perhaps together with the requisite data

sets, are better determinants of usage and growth of data transmission than are DTL computers. Unfortunately, the available statistics, where terminals and data sets are concerned, leave much to be desired. Apart from the special case of telephone-type terminals, the Task Force estimates that there were in the order of 50,000 data terminals installed in Canada in 1970-71, of which 21,000 were TELEX and 4,000 TWX; the remainder cover the spectrum of data terminals, both on- and off-line, but the bulk of these fall into the low-speed category. An over-all growth-rate of not less than 20% to 1980 may be anticipated, yielding an estimated 310,000 installed data terminals at that time. This growth-rate is based on a combination of factors, including the growth in the number of DTL-equipped computers, and increases in the number of TELEX and TWX terminals, and is somewhat less than current predictions for terminal installation growth-rates in the United States.

Bearing in mind the provisos mentioned at the beginning of this sub-section, the growth in industry values, based upon the predictions above, rises from the previously-mentioned $937 million in 1970-71, to an estimated $4 billion in 1980. This represents an over-all industry growth-rate of 15.6%, and a rise in terms of economic output from about 1% GNP in 1970-71 to 2% GNP in 1980. Figure 10 illustrates the growth of the industry by segment and by total, after deductions for inter-segment trade, from 1970-71 to 1980.

Figure 10
Industry Revenue Estimates



Chapter V
Needs and Problems

1. SUPPLIERS

The industry consists of some 500 supplier-organizations, which range in size from a small services firm to a very large subsidiary of a multi-national computer manufacturing corporation, where the latter type of organization may be actively engaged in as many as three of the four supply segments. With such diversities of size and interests to consider, it is apparent that the needs and problems of suppliers can be very different. Common needs and problems, therefore, probably do not extend beyond the bounds of supply segments, and, even within a particular segment, it is likely that only suppliers of a similar size will find they share the same types of problem. The situation is further complicated by the fact that, in the competitive environment which largely prevails, one supplier's problem is often another supplier's opportunity. Any particular supplier, however, probably conceives of his difficulties as arising from one or a combination of four sources:

- From his immediate competitors in the same supply segment;
- from suppliers in other segments on whom he must rely for the provision of services or equipment;
- from organizations outside the industry which may provide key inputs without which he could not operate his business;
- from governments which may or may not be providing an environment in which he can operate successfully.

(a) Problems Arising from the Competitive Environment

In three of the four supply segments (hardware, service, and "other product") a competitive environment exists, where competitive bidding for equipment and service contracts and volume discounting are much in evidence. In this situation, the primary concerns expressed by some of the participants relate to "unfair" competition or "unfair" practices.

With regard to competition among hardware suppliers, widespread concern has been expressed about the market dominance of IBM. It is alleged, and with some justification, that its inordinate market share results in *de facto* standards being set for the whole industry in such diverse areas as computer systems architecture, input/output format dimensions, programming languages, and code specifications. To some degree, this has given rise to either a "follow the leader" attitude, or to competing in those niches where IBM is less pervasive. In reality, this has meant that any new entrants to the hardware supply segment face enormous obstacles in the scale of expenditures necessary to obtain more than a very small share of the market.

In the service supply segment, competitive pressures are most acute. In addition to some 250 organizations identified by the Task Force, about 90 others have gone out of business in the last two to three years. The reasons are many: under-capitalization, over-capacity, lack of planning, lack of marketing, and lack of service specialization and differentiation. In this same period, service bureau organizations have also expressed growing concern with regard to what they see as "unfair" competition, which is developing as a result of the entrance or continued operations of the common carriers, the banks, the universities, and, to some extent, the hardware suppliers. These problems are discussed in Part C of this Report.

The "other product" supply segment is characterized by having perhaps the fewest problems. A competitive but profitable environment exists, where the focus of concern centres upon potential product obsolescence. Studies by some of the participants have been undertaken to determine, for example, the future prospects for continuous print-out forms in the face of competition from visual display units.

(b) Problems Caused by Inter-Segment Supply

The segment most affected by the actions of other industry participants is the service supply segment. Essentially, companies in this segment are placed in the position of users of equipment and services, and they suffer from almost the same needs and problems as many of the users they attempt to serve. Many of their difficulties, particularly those of the service bureaux, are brought about by their comparative sophistication. This is because a high degree of efficiency in the use of equipment, service and personnel, is mandatory in order to maintain or achieve profitability. If any of these three elements essential to their operations falls short of expected performance, the results may have a critical effect on the organization's ability to remain in business. In this respect, they probably differ from the average user. The focus of their needs, and the potential or actual cause of some of their problems, is related to hardware and communications supply.

"Hardware" in this context is perhaps the wrong designation, because the service supply segment's concern here focuses upon operating systems, executive, and communications software. Traditionally, the hardware manufacturers have been the supply source of these key items, but because of their extremely complex nature and the uses to which they are put, it has become necessary for many service bureaux to modify and maintain such software. The associated modification and maintenance costs to a particular service bureau often verge on the prohibitive, and are frequently viewed as non-productive functions. On the other hand, the absorption of these costs by the service bureaux represents a cost-saving for users or potential users.

With regard to data communications services, Task Force interviews indicate that most of the concerns expressed by the service segment center upon price, and that they range all the way from dissatisfaction with the pricing structure as being unsuited to the characteristics of data transmission, to frustration with the large differentials between U.S. and Canadian data transmission prices. In the long run, such differentials are seen by the service bureaux as one of the major factors which could induce Canadian users to be served from the United States. Furthermore, since a large part of service bureau costs are fixed, the volume of business is the primary factor affecting profitability. The price of data transmission enters into this equation because, in general, it effectively circumscribes the geographic area which may be served, which in turn limits the potential volume of business.

Other concerns focus upon the quality and reliability of service provided by the common carriers. In some instances, it has been stated that transmission error rates still remain at a level which jeopardizes the business relationship between service bureaux and their clients.

A normal competitive situation does not exist in the data communications supply segment. Here, the traditional common carriers, *i.e.*, the telephone and telegraph companies, have co-existed in serving prescribed sections of the telecommunications market. With the increasing requirement for data communications, both have responded to market demand, and a competitive situation is said to exist mostly in factors other than price. Consequently, the competitive pressures are probably limited to such items as the range of services offered; the quality of services; the availability of maintenance; and perhaps the image the companies portray. The rate of growth in the communications field as a whole has resulted in there being a major need for this segment to continue large-scale investment funding for upgrading facilities and plant extension. Entry by new organizations into this segment as common carriers is effectively prohibited by the necessity of obtaining rights of way, or an allocation of the frequency spectrum, and possibly by precedents relating to monopoly service.

(c) Problems Arising from Outside the Industry

Apart from the consideration of government actions, perhaps the foremost problem arising from outside the industry is the relatively small size of the Canadian market. It affects all segments of the industry to some degree, but particularly those supply functions which depend on economies of scale for maintaining internationally competitive prices for products and services. In hardware, this factor is evident in short production runs and disproportionate marketing costs; in services, the market potential is limited to a small number of major towns and cities; in data communications, the transmission volumes are still a relatively insignificant part of total communications volumes; and "other products" suffer from the same limitations as hardware.

Another problem relates to the availability of venture capital in Canada. Much concern has been expressed, particularly by the smaller and medium-sized suppliers in the service segment, that such organizations as Canadian banks, financial institutions, and the money markets generally, are unable or unwilling to provide initial and continuing capital requirements for high-technology areas at reasonable cost. This would include needs for the financing of leasing arrangements. It has long been recognized that Canadian investors have been conservative in their support of new areas of endeavour and in this regard the computer/communications industry is no different from any of the other emergent industries. Furthermore, this reluctance is not surprising in view of the poor financial record of many of the entities in the service segment, and of a much smaller number in the hardware supply segment. It may have been presumed that problems associated with the supply of capital from Canadian sources would be overcome when companies within the segments under consideration have demonstrated consistently profitable operations, but there is some evidence to suggest that even this may be insufficient to loosen the most conservative purse-strings.

(d) Problems Arising from Government-Industry Interactions

This situation is perhaps the most difficult to describe. The range of concern encompasses the very general to the very specific; from problems relating to rates of taxation, to government support of research and development costs for software packages. Given this wide variety of interests, and the range of products and services in the computer/communications field, it is difficult to summarize the industry's concern with regard to the over-all business climate as influenced by government. Undoubtedly, no supplier can afford to be uninterested, because the events of 1970-71 have dispelled any doubt that economic conditions are determinants of the level of user activity. As regards specific support, however, the concerns of the industry have been expressed to the Task Force as follows:

- Some government support programmes are available; the difficulty is in knowing which are available, which are appropriate to computer/communications, which to apply for, and where to apply.
- There is a general belief that there are no workable support programmes for software development, in contrast to hardware and equipment support programmes.
- There is concern that support, once applied for, takes an inordinate length of time to materialize, due in large measure to what appears to be a process of interminable negotiations.
- Due to the general nature of government support programmes, there does not appear to be recognition of specific needs in the light of technological developments. Software-hardware combinations are cited.
- Some suppliers regard the current lack of support beyond the development stage as effectively deterring viable long-term innovation. They cite marketing costs as the prime expense in the new product or service cycle.
- There is a widely-held belief in the service segment that insufficient government internal data processing is in the hands of commercial service bureaux.
- There is concern that when a new product or service has received support by government, the departments do not demonstrate their faith by placing significant orders for the product or service for their own use.
- There is concern that information relating to Canadian-developed products and services does not receive the widest possible circulation within governmental departments.
- There is a belief that, as long as the criteria for support remain unknown, some applications for financial assistance are rejected for reasons unconnected with the purpose of the aid.
- There is concern that the imposition of customs duties and excise taxes on imported hardware no longer serve the purposes intended. Since these additional elements of cost must be passed along to the customer, they are viewed as factors which make foreign services more competitive by comparison.

While the situations described above do not cover the complete range of the computer/communications industry's needs and problems, they do highlight the main concerns expressed by the industry. Further discussion of this subject is contained in parts C and D.

2. USERS

Large and medium-size businesses and institutions comprise the great majority of users of computer/communications equipment and services at the present time. The purposes of these organizations cover the spectrum of economic and institutional activities, their computer/communications systems being applied to a large number of administrative and operational functions.

Many of these organizations were users of unit-record equipment and other electro-mechanical devices before the nineteen-sixties, so that the ideas associated with data manipulation were not entirely new to them when computers became commercially available. This may have been a handicap, for in many instances the concepts associated with unit records were carried over into the computer era. The advantages which the computer offered were often foregone in favour of relatively simple, discrete tasks which had previously been manual or semi-manual operations. Successive generations of computers have introduced increasing technological complexity in methods of operation, coupled with an enormous increase in speed. Emphasis in recent years on efficient operation of the machines and conversion to new generations of computers has forced the necessity of focussing on the technical problems involved, rather than upon satisfying the needs of users. The requirement for skilled manpower and new applications, plus the associated demand for more and more highly powered computation and storage devices, have combined to increase total computing costs to the point where they have come under intensive scrutiny in both the private and public sectors. There has been a concurrent re-evaluation of the computer's role and a reappraisal of its contribution.

The problems encountered by users were expressed to the Task Force in many briefs and submissions. These were very broad in range because, in general, the Task Force avoided asking particular questions of potential respondents in order to prevent pre-conditioned replies. As a result, the briefs revealed many diverse and independent viewpoints.

To gather supplementary, structured information, the Task Force undertook a number of user interviews to determine the status of computer/communications in different sectors of the economy; to assess the impact of past experience in computing; and to uncover trends, problems and issues relating to the future use of computer/communications. Apart from studying special computer/communications applications in financial, educational and hospital systems (Volume II) as well as reviewing studies done by other organizations, the Task Force interviewed a sample cross-section of computer users. The organizations approached included business and industries, data communications users, universities, federal government departments and provincial governments. In every case, the investigations attempted to cover a sufficiently broad and representative sample of users to ensure that valid conclusions could be drawn.

The major problems faced by users are shown in Table 2 at the end of this chapter. They have been extracted from many source documents and have been summarized by class of user. While the list of problems is by no means exhaustive, the tabulation is intended to highlight the main areas of concern which may be summarized as follows:

- Computer and communications costs for users are generally considered to be excessive. It is not always clear whether the results achieved are commensurate with the expenditures involved. There is much concern among users regarding ways and means of reducing these costs.
- The management and control of information processing systems have left much to be desired. Senior management, either by default or by lack of knowledge, has not exerted sufficient direction, while technical computer personnel have not paid sufficient attention to the needs of the organizations they serve.
- Despite progress, computer/communications has not yet reached technological maturity. There is much room for new types of application systems, hardware, software, and associated developments in standards and other areas.
- Education and training have been outpaced by the technological developments in computer/communications.

(a) Computer and Communications Costs

One of the major reasons for the current reappraisal of computer systems and their associated costs is connected with the high expectations accorded these machines a few years ago. The situation has been compounded by the widely-advertised, dramatic drop in cost per unit of computation. But neither this factor, nor the deeper involvement and added experience of computer systems personnel, seems to have resulted in more effective systems. The costs of operating computer installations have not declined, even if the amount of work accomplished has increased. In such circumstances, it is often easier to look for ways and means of cost-reduction than to redirect efforts towards greater effectiveness.

The most widespread concern of users was the need to reduce the cost of data communications services. Many future applications of computers will depend heavily on communications since the services will be shared by many users and will need access to remote computers and data banks. Data communications costs are considered by many users to be excessive, particularly because rates are higher in Canada than in the U.S., over equivalent distances. In some cases, high data communications costs are limiting the development of new systems which would be of economic advantage to users. Mechanisms for achieving cost-reduction, through more effective utilization and the expansion of competition are explored in more depth in Chapter IX.

Reduction of data communications costs is important in controlling the rate of increase in the costs of government data processing. As the volume of information handled by governments continues to grow, and as steps are taken to improve efficiencies and reduce costs, more communications services will be utilized.

In the private sector, the Task Force investigations showed that computing costs are under intensive scrutiny. The steps that are being taken to reduce and minimize increases in costs include a general trend towards centralization of hardware and of management control. More particularly, this includes the investigation and implementation of consortium arrangements whereby two or more companies are combining their computing requirements on larger machines so as to take advantage of the economies of scale. Many business and industry users are seeking means of reducing the costs of computer systems, program development and maintenance through the use of more sophisticated, higher-level systems definition and programming techniques. Methods for data acquisition, storage and retrieval are being studied and new approaches to improve efficiencies are being explored. In business and industry, trends towards systems which make greater use of data communications and remote-access capability have generated a need for lower data communications rates.

Many of the organizations interviewed have investigated the possibility of using commercial computing services to meet their needs. In the great majority of instances the investigations were launched because of the expected reduction of high computing costs, identified as one of the most significant user problems. Of the senior management respondents, 85% stated that cost-savings would be a primary inducement to the use of outside services. These managers were asked to specify the extent of the cost-reduction that would be necessary to induce them to convert to commercial services. Their responses may be summarized as follows:

Extent of Cost-Reduction Required	*Frequency Selected*
At least 10%	15%
At least 25%	70%
No estimate	15%

Clearly, commercial service bureaux have been unable to meet these price objectives, since few organizations have adopted the alternative of using commercial general-purpose computing facilities as a substitute for in-house capability.

Respondents cited other important factors which also inhibit their conversion to commercially offered services, including: (a) the uncertainties regarding the financial stability and consequent continuity of service from the commercial service organizations; (b) insecurity regarding unauthorized access to private data; (c) absence of assurances on the legal liability of the supplier in the event of non-performance or loss of data; (d) costs of conversion to machines different from the existing in-house facilities, and diversion of systems and programming efforts to this purpose; and (e), loss of direct control over an important, integral function of the business. Other considerations, which act as constraints on some organizations, are: (a) the uncertainties regarding future costs; (b) corporate policies; (c), special conditions, such as dedicated

facilities and special software or hardware configurations not readily duplicated by the commercial service organization. Whether or not these reasons are valid, they represent the present views of users, and changes in attitude must occur before there can be extensive replacement of private computer installations by commercial offerings.

(b) Planning and Control

The need for consistent and progressive policies and objectives for the proper development of computer/communications systems in organizations is broadly recognized in all sectors of the economy. Many of the computer systems now in use have, at best, little cost-effectiveness. This condition originates from the high rate of development of new systems and from the tremendous technological changes which have been incorporated since the original introduction of computers. Senior managers have had to rely on technical staff to provide the focus for planning and control and have not been able, for various reasons, to exercise sufficient managerial influence over current or future computer and communications activities. This function is now in a transitional phase where control is shifting to senior management. Technical computer personnel are finding it necessary to develop a greater awareness of management problems to reduce the communications gap and to lessen the effects of the dichotomy of technical and business aims.

Co-ordination with regard to the establishment of policies and objectives is needed between governments and other public institutions in areas of common interest and problems, *e.g.*, educational, hospital, municipal, and other systems.

Rationalization of university computing capability and greater standardization of university administrative systems and programs will necessitate greater co-operation among the institutions involved. The possibility of a Canadian Universities Network (CANUNET) is now being investigated and, in Quebec, the "Système d'information de gestion universitaire" (SIGU) is a joint project for the development of a group of administrative programs.

A prior requisite for such improvements in administrative processes in various parts of the public sector includes the definition of the ownership of, and authorization for, access to the data. Only by such means can the responsibility for maintenance of the necessary data banks be assigned and suitable procedures set up to prevent unauthorized retrieval, thus protecting the privacy and confidentiality of the data.

Another general problem which requires resolution before computer operations in both the private and public sectors can be made truly effective is to discover meaningful ways of assessing the real contribution of computer systems and programs. In the case of an industrial enterprise, the ultimate measure of the results of an undertaking is the difference between revenue and costs. Such measures are only partially effective where computers are concerned; even where systems have been designed to produce cost-savings,

means for determining the effectiveness of the systems are lacking, and while some procedures are now becoming available for this purpose, they are not yet sufficiently well-developed.

(c) Innovation and New Technology

A number of changes are needed in technology, both to hardware and software, as well as the evolution of new systems-concepts from their present stages, before the potential of computers and communications can be realized. For example, in data communications, present call set-up times are excessive for systems such as credit checking, which uses small amounts of input data and short response messages; the quality and integrity of transmission (error rate) is frequently inadequate; the quality varies among regions; and tariffs are inappropriate for specific applications. In commercial systems, the flexibility of computer programs and their responsiveness to environmental, organizational and other changes require improvement. New and better processes allowing individuals to interact directly with computer/communications systems are required. Present systems-design and programming procedures are time-consuming and cumbersome.

Further improvements in the capability of computer systems to interact with other computers would improve flexibility and usefulness. If, for example, private computer systems could interact easily with bank systems, improvements in payroll applications would be possible. Similarly, direct communication between separate ordering and invoicing systems would further speed these processes. The efficiency of the exchange of data between business and government could be improved by automation.

As computer systems are developed which extend beyond individual organizations, assured ways of protecting the privacy and confidentiality of data, particularly in sensitive government areas, will be needed. Standards are a prerequisite for interconnection of systems and will have to be adopted for data formats and structures, for system interfaces, for codes to identify individuals and other information and for those parts of programs which are common to many users. Data communications links will become essential, so that systems can be integrated and data efficiently exchanged.

While many varieties of computer hardware and peripheral equipment are already available on the market, the cost of some types of equipment, particularly terminals, remains too high to meet the economic requirements of some systems, such as credit card checking.

(d) Training and Education

Computer training and education have not kept pace with the rapid advance of computer/communications technology and its increasing ubiquity. As more individuals entering business or government service are required to interact

with computers in their daily tasks, there is a growing need for them to have a basic understanding of computer functions. There will be an increasing necessity for students to experience a general exposure to computers at an early stage of the educational process.

Although the universities and colleges are producing graduates trained in computer sciences and programming, Task Force investigations showed that much of the training of computer systems analysts and programmers is undertaken within the organizations in which they work. This method is exceptional in comparison with the majority of disciplines and reflects the need for more appropriate training programs than now exist. Attempts are being made by some technical associations, in conjunction with educational institutions and with business and industry, to improve training courses.

In the future, systems analysts will need greater understanding of the administrative, managerial, and interactive processes within their employer-organizations. To produce such generalists will require multi-disciplinary educational programs, few of which are in existence today. Since the educational requirements, particularly for systems analysts, are not yet well defined, it is not surprising that accreditation of computer professionals, similar to that of engineers and accountants, is not at present widely regarded as practicable. As the computer profession matures, recognition of professionalism through accreditation and the availability of sufficient well-trained personnel, might help to reduce the turn-over of staff which is now a considerable problem in some organizations.

Table 2
User — Needs and Problems Summary

Business and Industry

1. Greater involvement of management in the planning of computer applications and improved management training.
2. Communication gap between management and computer technologists — need for a service rather than a technical orientation.
3. Improved means of evaluating the operating and development effectiveness of the computer's contribution.
4. Reduced costs of systems development and programming.
5. Reduced cost and improved quality of data transmission.
6. Increased flexibility and responsiveness of computer systems — need for new developments in this field.
7. Improved training of computer technical staff — multidisciplinary approach to training systems-analysts.
8. Reduced overall costs of computing through centralization or other means.
9. Data and systems security, protection of privacy and confidentiality of business data.
10. New hardware developments and systems concepts to meet present unfilled needs.
11. Introduction of computer training at an earlier stage of the general education process.
12. Means of exchanging data between different businesses and between government and businesses more effectively — system interconnection.
13. Development of more effective and lower cost data management and systems development technologies.

Federal Government

1. Consistent policies and objectives for development of computer systems, and for planning and co-ordinating government computing activities.
2. High security requirements for sensitive data (*e.g.*, DND and RCMP) and protection of confidentiality of data in other cases.
3. Reduced duplication in systems development between departments, exchange of information on available systems.
4. Standardization of data to support functional computing centres and for various other purposes.
5. Reduced growth-rates in computer and communications costs.
6. Reduced staff turnover and improved availability of high quality staff.
7. Access to computing capability for all regions of Canada.
8. Defined authority for "ownership" and access to data.
9. Improved management of computing centres with more emphasis on service as opposed to hardware and software considerations.
10. Improved assessment and reporting of the contribution of computers.
11. Resolution of the problems of dehumanization and depersonalization resulting from extended use of computers.
12. Resolution of foreign ownership and control issue.

Provincial Governments

1. Co-ordination between various provincial governments and with the federal Government in the development of common policies and objectives on common problems.
2. Definition of areas of jurisdiction and co-ordination with other communications problems.
3. Availability of computer and communications services to support industry, particularly in under-industrialized areas.
4. Protection of civil rights of provincial citizens, particularly as regards privacy and control of data and avoidance of depersonalization.
5. Attracting and holding trained computer personnel, especially in remote provincial areas.
6. Dissemination of information on computer systems developments to avoid duplication of effort.
7. Computer standards for data, hardware interfaces and common individual identification.
8. Lower communications costs and resolution of the problems of poor data communications in some remote areas.
9. Maintenance of the economic and technical integrity of provincial telecommunications carrier networks.

Universities

1. Continually increasing need for expanded computing capability to satisfy larger de[illegible] and and increasingly comple[illegible] research problems.
2. Stabilization of computing costs.
3. Ability for each to have knowledge of and access to developments at other universities, such as data banks for research, etc. — requires information exchange procedures, low-cost communications and standard data formats
4. Rationalization of computing capability and standardization of administrative procedures and programs.
5. Improvements in ease of student access to computing capability and improved service to students.

Municipal Governments

1. Co-operation with federal and provincial governments to avoid duplication of work on such matters as census data, vehicle registration, etc.
2. Standards, particularly for personal identification.
3. Improved availability of professional computer staff.
4. Privacy and confidentiality of data.

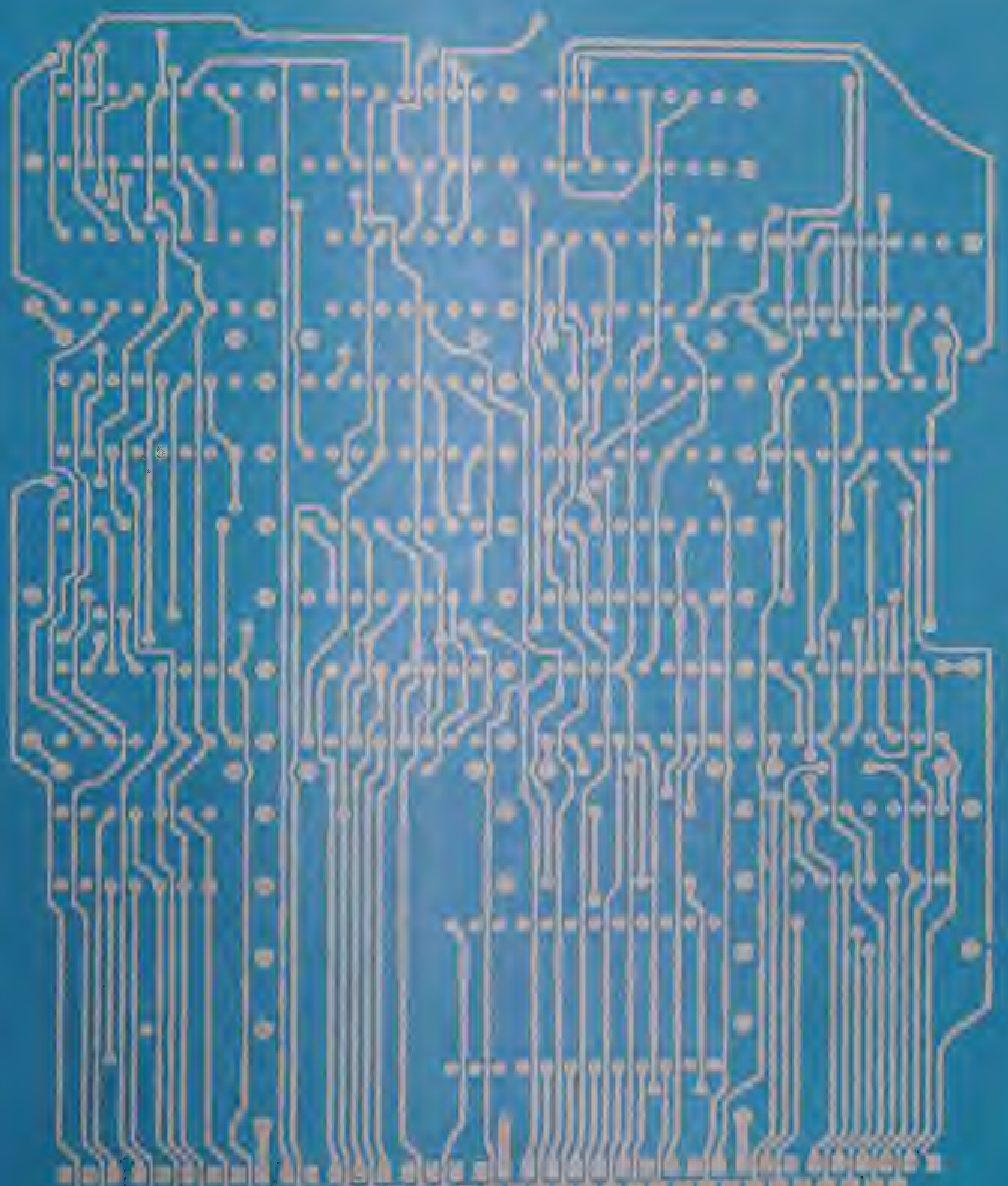
General

1. Legal protection of copyright on systems and programming.
2. High quality and integrity of data transmission.
3. Removal of restrictive tariffs and technological improvements in data communications.

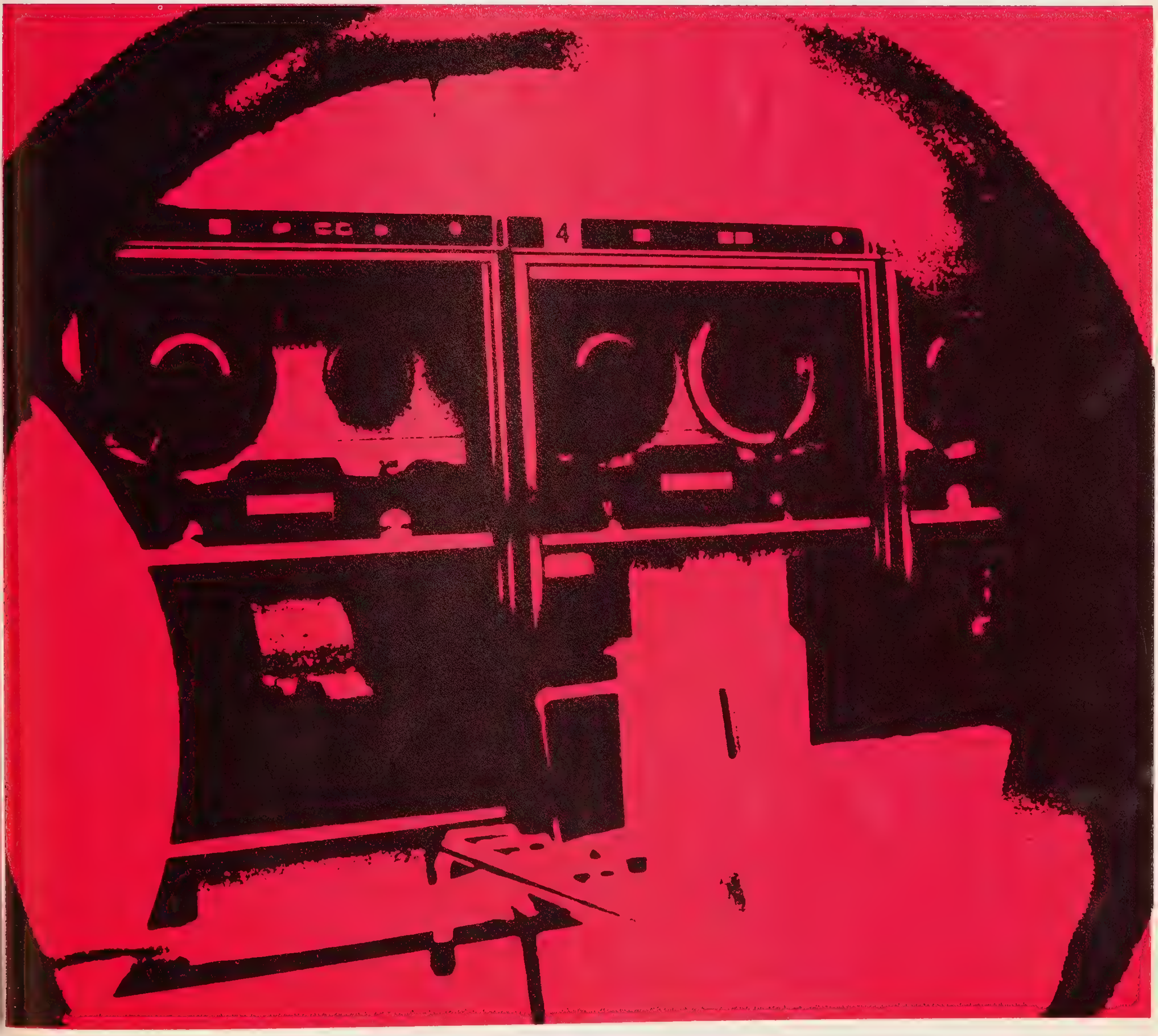
Source: CCC/

Part 8

Policies and General Recommendations



Chapter VI
Policy Approach



Remote access to computers is now an indispensable tool in the operation and administration of large and medium-sized industrial and business undertakings. It is becoming increasingly vital to the degree of efficiency required to maintain a competitive position in national and international markets.

At the same time, in the public sector all levels of government — federal, provincial and local — are finding growing benefits in the possibilities of rapid information storage, distribution and retrieval through computer/communications technology. Already, these applications in the public domain have demonstrated their profound impact on society by their role in crime detection, health care and welfare, national security, financial transactions, transportation and manpower deployment, to give some prime examples.

Thus, computers and communications are intricately involved in the economic functioning of the nation and have started to show their social significance in applications which reach into the lives of every individual. At present, this latter process is in its infancy, but it is expected that within this decade the public at large will experience a much greater involvement in computer-based systems which will eventually reach into every home. Education, entertainment, information services, community interaction, shopping services, will extend the sphere of computers from their present role, namely in business, industry and government, into all segments of society.

It is this pervasiveness of computers and communications and their penetration into every aspect of professional and private life which is the subject of concern and study all over the world.

1. THE CANADIAN PROBLEM OUTLINED

Theories, policies and experience in other countries may be of interest for the purpose of a comparative evaluation, but they cannot be directly applied to the Canadian situation. Geographical and physical conditions, demographic and industrial distribution, regional differences and disparities, bilingualism, the constitutional separation of powers, the political system, and the social and economic structure peculiar to Canada are of greatest significance in the assessment of solutions for Canadian computer/communications problems.

In summary, though by necessity over-simplified, the main contributing factors are:

- The basic technology of computers is almost entirely in the control of foreign-owned corporations. Equipment is mostly manufactured outside Canada and imported, subject to import duties. A relatively small proportion is assembled in Canada.
- The Canadian market for commercial computer services is limited. Therefore, the scale of commercial operations, with a few exceptions in the highly industrialized areas of the country, has not reached a level which allows a satisfactory return on investment for equipment and programming.
- The widespread use of communication networks for remote access to computer operations has not yet materialized, partially because of prevailing communications rates and limitations of available communication services.

- The sheer dynamics, capacity and associated economics of U.S.-based operations often favour the adoption of U.S.-developed service packages, or direct use of U.S. computer services, even when similar Canadian services are available.
- Business and industry have been slow to adapt to the new tool of computer technology in relation to the rate of technological advance.
- The volume of research and development in Canada is not yet at a level to provide a continuing, viable product base in either hardware or software.

Under the many pressures and other factors identified in this Report, present Canadian needs are being met by a great variety of unrelated actions and systems, mostly (90%) confined to in-house operations of business, industry and governments. This fragmentation leads to economically unsatisfactory operations; to financial instability of commercial computer service enterprises; and adds to the attractiveness of more sophisticated and perhaps less expensive offerings from the United States. In the light of the growing economic and social significance of computers, this should be seen as a disturbing situation, with increasingly serious implications.

Before drawing conclusions from these observations, one must make a clear distinction between the computer hardware, computer programming or software, application programming, and the provision of computer services. Whereas computing equipment, including its main machine-oriented software, is essentially "neutral" to the economic and social environment in which it is used, the programming for a specific application and the provision of services depends to a much greater extent on the special interests and circumstances of the community of customers. Some applications are standard the world over — for example, hotel or airline reservations. Others, however, depend on national characteristics, as in the operation of financial institutions and social services — and most particularly in areas where language, education and cultural values are involved, in which case computer services will perform functions very similar to those of the present news media, broadcasting and educational services. There is obviously a considerable difference between a foreign influence limited to the provision of hardware and software, and one which permeates the whole field of application programming and computer use. A domestic capability for application programming, systems development, and provision of services is essential for Canadian solutions, in the economic sector as well as in the rapidly growing fields of general social significance. If such a capability is not maintained, the inevitable pressure of foreign technological advance will lead to situations increasingly in conflict with Canadian concepts, aspirations and goals.

2. APPROACH TO A SOLUTION

The Task Force has come to the conclusion that the most promising approach to satisfying Canadian users' needs and countering the emergence of foreign domination in the computer application field lies in a concerted effort to strengthen the Canadian presence in this field, both technically and economically, through a policy of improving domestic and international competitiveness. A multiplicity of objectives must be established, based on a common understanding and requiring co-ordinated action by many agencies and authorities. In particular, governments at all levels should aim at a general

acceptance of certain guiding principles from which detailed policies and actions can be developed. Such principles should be:

- To recognize the vital importance of computer/communications to Canada;
- to ensure that the socio-economic effects of computer/communications conform both to accepted national objectives and to regional interests and values; to promote and support the development of socially desirable systems; and to counteract undesirable trends, such as foreign domination of the industry, and invasion of personal privacy;
- to ensure the evolution of data communication systems towards an effective, coherent data communication network.

The Task Force is convinced that in this rapidly changing technological field, the key to the solution of Canadian problems is a close working relationship between governments, industry and users. Those involved must monitor change in the industry and its environment, define problems and opportunities and continually adapt policies and programs to actual conditions. Therefore, the Task Force recommendations take the form of broad and flexible policy guidelines, leaving adjustments in their implementation to interactions between the public and the bodies responsible for administering the policy.

The keynote of the recommendations is that governments should promote an orderly and planned transition that will assist both the private and public sectors to achieve the greatest possible gains at the lowest possible cost. The role of government must be carefully defined, so as to maintain a proper degree of Canadian independence and further the development and self-reliance of the industry to the highest possible degree. In broad terms, the Task Force has identified the following objectives, which are described in much greater detail in the various parts of the Report:

- Innovation in the Canadian-based computer application and service industry should be encouraged and supported by government incentives.
- In the provision of commercial computer services, the opportunities for the free play of competitive market forces should be maximized and government intervention should be brought to bear only where competition is about to be eliminated through monopolistic tendencies, or where protection of the consumer interest requires explicit regulations.
- Steps should be taken towards a periodic identification of user-needs and evaluation of the impact of existing and projected computer/communications systems on society.
- Applications of broad social significance should be given priority in their support by public funding for pilot-projects.
- Steps should be taken to foster the evolution of a cohesive data communication network, providing access to every part of the country.
- Policies in the data communication network development should be oriented towards improving service availability and rate structures in Canada, in order to offset economic and technical incentives for meeting Canadian user-needs through facilities outside Canada.
- In the development of rate structures for data communication services, attention should be paid to rates for special services and specific communities of interest, in which geographical distance is of minor or no influence.

- The spending of public funds to meet the internal data processing requirements of governments and public institutions should be oriented towards strengthening the Canadian controlled service and applications industry.
- Standardization in the field of computer/communications equipment, methods and procedures should be encouraged.
- At all levels of education and training, Canadian expertise and familiarity computer/communications technology and its applications should be strengthened.
- Tariffs on the import of equipment and components not manufactured in Canada should be reviewed, with the objectives of removing unwarranted costs to Canadian users.

Moving from the setting of objectives of this kind to the necessary actions for implementation, one is faced with the complex system of Canadian political and organizational structures. First, there are the governments at federal and provincial level, with their respective constitutional areas of jurisdiction; this aspect is dealt with at length in Volume II. Second, there is the unregulated industry in the manufacturing, computer service, engineering and consulting sectors. Third, there is the communication service industry, subject to regulation by federal or provincial regulatory bodies. It can be seen that actions towards meeting the stated objectives are bound to cross all these institutional borderlines. The Task Force recommendations therefore emphasize a close understanding and co-operation between governments at all levels, and between the public and private sectors.

3. GENERAL RECOMMENDATIONS

Accordingly, as a first recommendation, the Task Force draws the attention of governments at all levels to the importance of computer/communications with respect to the social and economic well-being of the country, and recommends that:

Rec. 1 Computer/communications (*i.e.*, computer services by remote-access through communication facilities), should be recognized by governments as a key area of industrial and social activity, and steps should be taken towards strengthening of the Canadian industry in this field, and co-ordination of its development to the benefit of Canadian society.

In the furtherance of the closest possible co-operation between public and private sectors towards the continuing development of a national policy, the federal government must take steps to bring together all concerned and to permit a feedback mechanism for assessing impacts and trends in relation to national objectives. The Task Force therefore recommends that:

Rec. 2 The federal government should take specific measures, as outlined throughout this report, to promote a high degree of co-operation between public and private sectors in the development and execution of policies for computer/communications in Canada.

Some aspects of control in the computer/communications field fall clearly within the jurisdiction of the federal government, while others are clearly within provincial jurisdiction. In a number of significant areas, jurisdiction is intermeshed, and subject to varying interpretations. It is clear, however, that a closely co-ordinated approach across Canada is necessary, if fragmentation and incompatibility are to be avoided. The Task Force therefore recommends that:

Rec. 3 In the formulation of national computer/communications policy a unified approach throughout Canada should be stressed as a key factor requiring close co-ordination between federal and provincial actions.

At the federal level, many of the stated objectives call for government involvement in a variety of forms. Many different departments and agencies are concerned with particular aspects of the computer/communications field, for example: with regard to competition policy; industrial incentives; common carrier regulation; research and development; technical standardization; and general telecommunications policy.

Policies in all these areas cannot be melded together into a useful national program without internal co-ordination. Accordingly, the Task Force considers it fundamental to the implementation of the recommended policies that:

Rec. 4 In the area of federal responsibilities a Focal Point should be established within the government for co-ordination in the development, formulation and continuing evaluation of national policy in all matters pertaining to the field of computer/communications.

At the Focal Point, the actions and concerns of many different government departments, agencies and institutions, on matters related to computer/communications, would be considered in their mutual relationship, and analyzed with regard to the effectiveness of government measures in the light of an over-all computer/communications policy. New measures could then be proposed, as required. Such a role at the Focal Point clearly involves two distinct functions:

- A strategic planning function, to advise on the formulation of long-range national objectives within the framework of general communications policy, and to lay the foundation for future policies; and
- a program co-ordination function for the assessment of current trends, evaluation of government actions, and identification of proposals for new government measures.

The fact that recommendation 4 is addressed to the federal government reflects the mandate of the Task Force, which is specifically related to federal government policies. However, it is clear from the wording of recommendations 2 and 3 that the development of national policies requires close co-operation between the federal and provincial governments, and between them and the private sector. Recommendation 4, in conjunction with 3, may therefore be extended to cover measures which express a joint federal-provincial involvement in focussing attention on the development of national policies in matters of computer/communications. Such measures are suggested in Part E of this Report, and amount to mechanisms for federal-provincial co-operation in pursuing policies of national scope. Of particular importance in this regard is the recognition of regional differences in factors such as population density, degree of industrialization, social and cultural values, and aspirations, which all require appropriate reflection in the interpretation of national policies, as they apply to the needs and situation in computer/communications in a particular region.

4. AREAS COVERED BY SPECIFIC RECOMMENDATIONS

Having focused attention in the general recommendations on the importance of computer/communications and its pervasiveness throughout all levels of government and all segments of society, the main thrust of specific recommendations, which are presented in the following chapters, is directed towards a concerted effort by governments to strengthen the Canadian presence in this field. Specifically, a number of possible measures have been identified in the following areas:

(a)Competition Policy in the Computer and Communications Services Industries

Recommendations in this area are concerned with certain constraints on the entry into this business, as well as regulatory measures to ensure an appropriate balance between the forces of free competition and those restraints made necessary to protect the interests of users and society. In the field of commercial data processing, no direct regulation of operations is recommended, although certain restrictions on entry were found desirable. Where data processing and data bank services are provided as a commercial service to customers through remote-access facilities, it was found desirable to institute a registration process, in order to make available information on suppliers and the types of services they offer. In data communications, where the established telecommunication carriers play a dominant role, the Task Force found it advisable to let the customer have greater choice and freedom in decisions on the technical and economic characteristics of services he receives. The government, through the established regulatory bodies responsible for telecommunication regulations, is brought in to play an active role in the definition of relationships between carrier organizations and customers. Further, the government, through its planning and co-ordination bodies, is called upon to work together with user organizations and the service industry on the evolution of a cohesive Canadian computer/communications network.

In the area of data communications services, the Task Force has developed general guidelines from which specific recommendations are derived. These quidelines are as follows:

- Government should assume a co-ordinating role in the planning and gradual implementation of a coherent data communications network, aimed at providing the flexibility, variety and cost-effectiveness required for distribution of computer services throughout Canada and for compatibility with foreign data communications networks.
- In the interest of stimulating innovation in the provision of data communication services, competition between existing common carriers should be encouraged, and independent entrepreneurs should be permitted to supplement common carrier services. However, the technical and economic integrity of the public switched-networks, in particular the present telephone voice network, should be protected.
- In order to ensure the orderly growth of a coherent data communication network, government should take steps to avoid the proliferation of incompatible terminals and data networks providing commercial services to customers.

(b)Policies For The Stimulation of Development

In this area, recommendations are presented on the government role in:

- Furthering of standardization of equipment, methods and procedures;
- supporting efforts towards the broadening of knowledge in the application of computers at all levels of education;
- providing incentives to all phases of industrial innovation, from research to marketing;
- co-ordinating the information exchange between organizations in the public and private sectors, so as to establish common approaches in the installation of data banks and information systems;
- supporting the development of computer/communications systems of broad social significance;
- providing opportunities for the Canadian controlled computer/communications service industry, through procurement policies in the public sector.

(c)Institutional Arangements Required to Implement the Recommended Policies

The proposed arrangements are primarily concerned with the area of federal responsibilities and cover the following points:

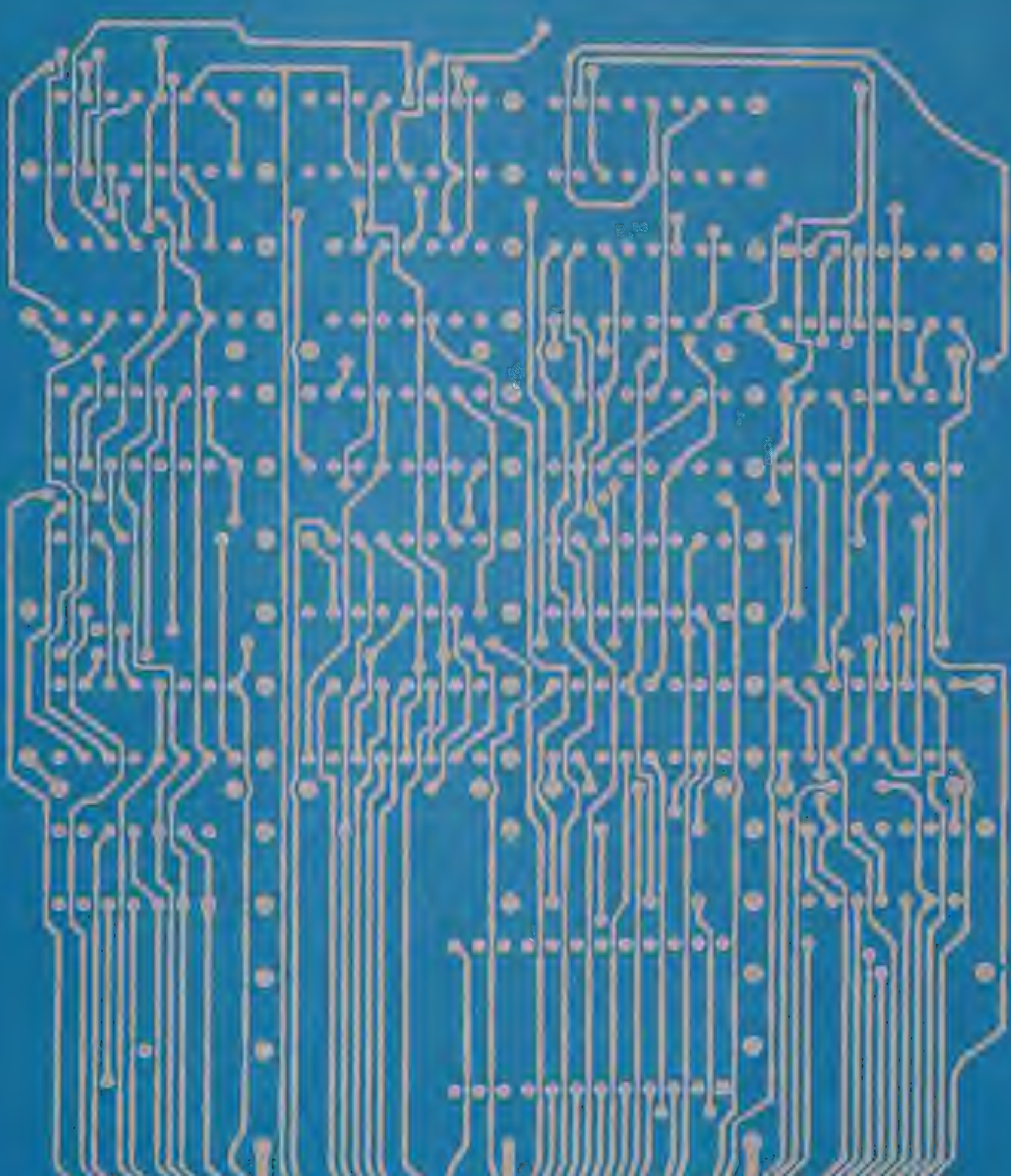
- Organization and terms of reference of the federal Focal Point for computer/communications;
- federal-provincial co-ordination;
- government-industry relationship, to ensure co-ordination between the public and private sector;
- regulatory requirements in the computer/communications field.

In the area of federal-provincial relationships, some suggestions for provincial action are presented, which may serve as a base for discussion with the provinces. The Task Force has had the opportunity to meet with representatives from the provincial governments and discuss the concepts presented in this Report.

Part

C

Computer/Communications Services



Chapter VII
Introductory Comments on Competition and Regulation

The computer/communications industry is marked by the existence of both competition and regulated monopoly in greater or lesser degree, depending upon the sector of activity. The Task Force has therefore found it appropriate to consider to what extent a competitive or regulatory framework might constitute the best possible environment for the development and rationalization of the computer/communications industry. A number of briefs submitted to the Task Force have addressed this question.

In Canada it is generally true that reliance is placed upon the "free enterprise" system, with the maximum possible latitude for individual initiative to enter into any given enterprise and compete for the available business. The general legislation in Canada relating to combines policy is designed to prevent restraint of trade and other unfair restrictions on competition. Government intervention, regulation, and in some cases direct provision of services are limited to those areas in which there is a natural monopoly, where a potential for unfair practices exists, or because a social need is not being met by the private sector. Computer/communications services, because they combine elements from both data processing and data communications, constitute a particularly difficult problem area for government policy-making. Will the industry continue to flourish best in a competitive environment; should government regulation be imposed with respect to entry, pricing, technical standards, or other criteria; under what conditions is direct government participation in the provision of services justified or desirable?

The basic question that must be faced in any determination of competition policy is the proper scope of the monopoly of the regulated communications common carriers. The restrictions imposed by telecommunication carriers on their customers are defended on the ground that the telephone monopoly should include all communications services and all related equipment, in order to maximize the efficiency of the carrier in planning and operation. The contrary argument is that the monopoly should be limited to those areas of natural monopoly in which duplication is prohibitive, so as to maximize the advantages and possibilities of competition. Many of the submissions to the Task Force have indicated that competition can provide substantial benefits in communications, as in other regulated fields. In fact, the current pressure for change by the computer data processing industry results from the readiness of actual prospective competitors to offer diverse services and equipment on more favourable rates than the carriers, and to offer them to an important and growing class of users. This suggests that the elimination or modification of restrictions imposed by the carriers on such competition would have desirable effects. Among the expected advantages are more advanced and cheaper equipment, a reduction in communications costs through circuit sharing and other means, and faster satisfaction of the specialized communication needs of data transmission.

Competition appears to be not only of great potential value in computer/communications, but is in many ways becoming more feasible. Although technological advance often leads to greater sophistication and more complex

systems, this has not historically demanded ever increasing size and more monopoly. In the communications field, the most striking development is the progressive increase in transmission capacities and circuit availabilities. This may reinforce some of the natural monopoly characteristics of the transmission aspects of the carrier systems, but it lays the foundation for the growth of many competitive services which can be channelled through these systems. The argument has been raised a number of times to this Task Force that freer attachments, freer interconnections, and freer use of circuits should enable users to combine the advantages of an efficient mass network and individualized applications and services.

Along with the growth in transmission capability, there has been an increase in the sources of available technological competence and innovative talent, which could provide the basis for effective competition and for the diverse applications and services mentioned above. The suggestion is commonly made that such benefits should be foregone only for very sound reasons. Obviously they might have to be foregone if the removal of the present restrictions were accompanied by a significant risk of injury to the basic telephone network. But one should view critically the justifications advanced for such restrictions.

The development of competition in the computer/communications industry might also tend to spread the benefits of communications advances and of lower communication costs in other ways. For example, independent manufacturers may be prepared to supply terminal equipment for small, specialized markets. Independent service companies are prepared to arrange circuit sharing and to enable small users to obtain some of the advantageous charges for bulk transmission capability and large volume that are now available to only a few. These actions would enhance rather than discourage equitable treatment among users of the communications services including computer users.

On the other hand, a variety of arguments have also been raised to the opposite effect — namely that the scope of the regulated monopoly service provided by the telecommunication carriers be extended to include a variety of data processing and other related services. It has been argued that, in the long run, government ought to foresee, and move toward, an integrated single network which can provide services most efficiently and at lowest costs. Some are even willing to try to extrapolate far enough to predict the scale of future economies in order to demonstrate that this kind of result is economically irresistible. Since a data network to duplicate the existing carrier transmission facilities would be uneconomic, the argument continues that it should be decided in advance to reserve the computer/communications field for the basic telecommunications carrier system, suitably regulated.

This argument has a certain attraction and it sounds like rational planning. For a variety of reasons, it was not supportable in the light of Task Force research: the evidence indicates that market discipline, rather than regulatory pressures, would be likely to move more rapidly in the direction of lowering costs, advancing innovations, and providing a diversity of applications and services for the computer industry.

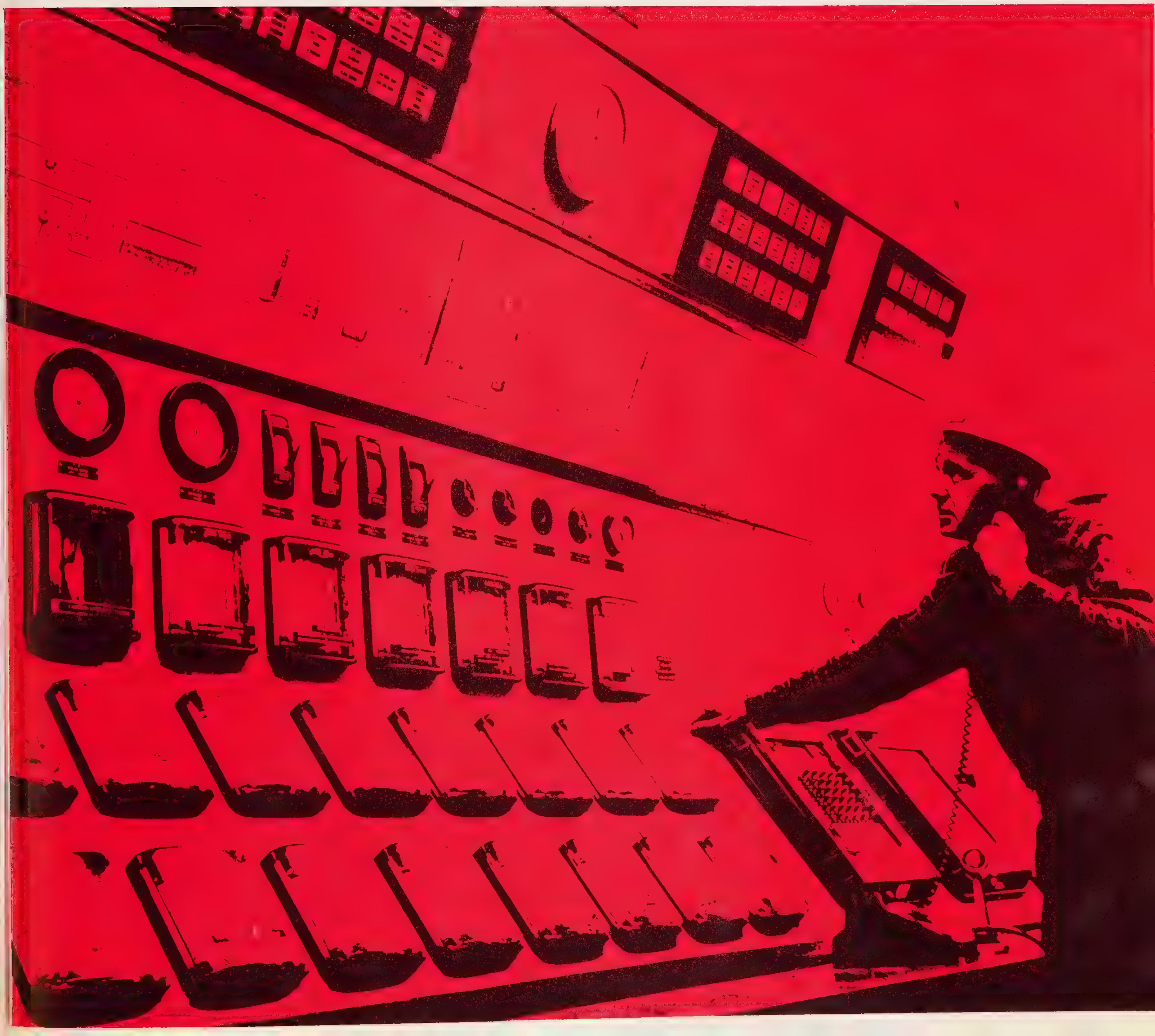
A number of economic arguments against unregulated competition exist that touch upon the computer/communications industry. In the public utility industries, the quality of service has many dimensions, not just its physical specifications, but its reliability, safety, regularity, frequency, and the financial responsibility of its purveyors. A good deal of the case for regulation is the importance of assuring that services meet acceptable standards in these various respects. Where price competition is very intense and consumers have only limited ability to judge the quality of a service, which may be particularly true in information processing, the decline in price can lead to a skimping on safety, reliability, and other service characteristics that consumers may have difficulty in detecting promptly. Even if there is a danger of unregulated competition resulting in an unwanted deterioration in the quality of service, it does not necessarily follow that the proper remedy is to impose direct restraints on entry or on competition in price. Legally prescribed quality standards, for example, could conceivably give consumers of data processing services sufficient protection, without the necessity for suppressing competition in other respects as well.

The Task Force has concluded that the retention and expansion of competition in the data processing services industry is an effective means of ensuring innovative development. This must be paralleled by development of competition in data communications if the full potential of the technology is to be realized. Competition should serve the dual purpose of spurring innovative development and of limiting monopolistic tendencies which could, at this stage, hinder the growth of computer/communications. Detailed recommendations along these lines appear in succeeding chapters.

In this context, the Task Force welcomes the introduction of new competition legislation which would for the first time embrace services as well as commodities. Practices which would be subject to review under the proposed legislation include price discrimination, tied sales, directed selling, exclusive dealing, delivered pricing, and refusal to deal, some of which have been the subject of specific complaints to the Task Force. To the extent that these practices are not reviewable by the telecommunications regulatory agencies, the Task Force favours the passage of appropriate general-competition legislation which would maintain a suitable environment for free competition. In this regard, the recommendations of the Task Force in the ensuing sections with respect to free entry into the data processing service industry are all conditional on the existence of such a competitive environment, maintained by a Competitive Practices Tribunal with effective powers to review anti-competitive practices.

The Task Force is aware of certain problems presented by the terms of the draft legislation now undergoing revision. It may be, for example, that the legislation precludes the development of computer services consortia; such multi-firm organizations could contribute to the quality and availability of low-cost computer services. Other difficulties may also be presented by the interpretation of the language of certain other sections in the draft legislation. Nevertheless, the Task Force finds itself in support of the basic principles embodied in that draft; however, attention should be paid in the current revision to the specific developments in the computer communications industry.

Chapter VIII
Data Processing



1. PARTICIPATION IN GENERAL

The most important participants in the provision of commercial computer services are the independent service bureaux, of which there are about 20 larger and some 100 smaller, and the computer equipment suppliers. Some Crown Corporations and affiliates of common carriers also provide commercial services. In addition, there are certain private organizations which sell specialized services, using surplus capacity available on "in-house" computers. A new and important class of suppliers is developing. Its members include: the banks, other financial institutions, and consortia of businesses. Universities are also potentially significant commercial service suppliers.

Many of those companies and associations supplying data processing services commercially do so only as an adjunct to their main line of business which, in a few cases, may be quite distinct from either the computer or communications fields.

Progress in applied technology is closely linked to innovation and to the competitive selection process of the market. A large number of briefs received by the Task Force stressed the need to maintain a competitive environment in the computer services industry. There is a definite fear in the private sector that constraints or regulation of the industry would seriously impede the innovative process and technological development.

One supplier of commercial data processing services stated, in a brief to the Task Force, that the

"... competitive environment has encouraged technological advances and improved design techniques which, in turn, have produced a rapid and dramatic reduction in the cost of computing and therefore data processing. It is the freedom of this environment which has permitted the data processing services business to provide the innovation, specialization, flexibility and responsiveness required to meet the demands of users. This has meant lower costs to users, widespread availability of different types of service and new developments to meet user-needs. We believe the continuing success of the Canadian data processing services business depends on maintaining this free environment and that competition will continue to be socially and economically desirable."

Another respondent to the Task Force — again a supplier of data processing services — stated that

"... there is a need for an integrated network of computer utilities and telecommunication systems but we feel that this network can and will develop naturally without the necessity for extensive government direction...."

Many other respondents supported this position and one, from a user organization, analyzed the question of competition versus monopoly, as follows:

"Conditions in the service bureau business favour competition and show no tendency to supporting a natural monopoly. Relatively little capital is needed to establish a service bureau. The ability to lease facilities shifts much of the burden of capital requirements back to the computer manufacturer or leasing company. As the service bureau increases its size of operations there are technical limits to its optimum size which arise from the amount of computer memory and time needed for internal computer management of operations as the diversity of processing expands. In addition, the increasing cost of communications as services are extended further geographically from the computer location also favours the development of competitive alternatives.

"In contrast to the standardized services of public utilities, the service provided in data processing is diverse and a choice of many services to the users is essential for the meeting of all needs. Each user's requirements vary according to the size and type of business, organization, accounting methods and recording procedures. In this environment one of the most important requirements for success seems to have been the ability to innovate and develop specialized services to meet the requirements of each user."

The tenor of many briefs to the Task Force, reflected in the selected quotations given above, indicates the general concern of the private sector regarding the maintenance of an environment which will foster innovation in computer/communications. Many of the briefs, while stressing the need for a competitive environment and expressing fear of government intervention, at the same time emphasized that government action was necessary in some areas to prevent the development of unfair competitive practices. On the other hand, arguments were raised, as mentioned in Chapter VII, stressing the eventual emergence of a regulated monopoly.

The Task Force has examined all the arguments presented in the light of user-needs and problems, and is reluctant to recommend action which could result in the denial of new services, unless the providers of such services could, through their position or subsequent actions, stifle competition in the data processing services market. In principle, the Task Force takes the view that the data processing service industry is of such an individualistic and innovative character, and the variety of services which could be developed and marketed is so great, that the entry of new suppliers into the field will be beneficial to the development of the industry and to the user of computer/communications services. With this in mind, the Task Force recommends that:

Rec. 5 No restrictions should be imposed on the entry of any organizations into the commercial data processing business, unless such entry would lead to anti-competitive practices, not remediable under the general laws relating to competition in Canada.

The above recommendation refers only to restrictions relating to entry, and does not preclude the enactment of regulations governing the operation of data processing firms on such matters as privacy and liability.

2. TELECOMMUNICATIONS CARRIERS

The problems arising from the possible entry of the telecommunications carriers into the commercial data processing services field are complex. The underlying factors have been covered in detail in the Telecommission Study 5(a), (c), (d) and (e) and were also the subject of a number of submissions to the Task Force.

As described in the Telecommission reports there is a wide spectrum of possibilities for carrier participation in data processing. At one extreme is the total integration of the supply of computer services into the present range of services offered by the carriers to the public. This case is often referred to as "horizontal integration" or "horizontal diversification". At the other extreme, short of complete barring of computer services supply, is the requirement for "vertical diversification", or total "arms length" operation, in which a data processing affiliate of the carrier could be totally separated and even prohibited from providing services to its own parent. Between these extremes is an infinite number of variations, depending on the degree to which the data processing business is related to the communication business of the carrier. In one group of such options the carrier may act exclusively or non-exclusively as an agent for data processing firms, provide for distribution of data processing through its communication lines, and perform marketing, billing, consulting, and advertising functions.

Depending on the particular mode of operation, and depending on the particular situation of the data processing service market in an area or region, the effects of carrier participation on competition in the computer/communication field are quite different. Accordingly, the position on the question of carrier participation taken by users and competitors in different parts of the country and in different segments of industry is not uniform.

(a) Carrier Participation

There is, in Canada, a complex mixture of federal and provincial jurisdictions (as outlined in Volume II) with regard to carrier regulation, and a large number of commercial carriers, some of which are privately owned and some of which are Crown Corporations. In addition, some carriers are already providing commercial data processing services or are planning to do so. All the carriers providing data processing services, with the exception of CN/CP Telecommunications (which has a controlling interest in a data processing service company), fall outside federal jurisdiction. In Nova Scotia the telephone carrier has recently purchased a data services bureau. Québec-Téléphone provides data processing services as approved by the Quebec Public Service Board. The New Brunswick Telephone Company has entered into a service and marketing agreement with a time-share service organization. These are precedent-setting actions which reflect specific regional factors.

Some provinces do not consider that a separation of carrier and data processing functions would be appropriate to their situations at this time, nor that it is necessary to provide for legal protection against cross-subsidization or unfair competitive practices. Instead they maintain that there would be plenty of time to institute corrective action before such effects occurred. The provinces concerned are not now well served by private data processing companies because of the small local markets and they feel that it is first essential to make computer services available within their own territories, in order to support business and industry, and to ensure that the proper environment exists for the development of socially desirable systems. One of the provinces considers that the small demand for computer services in remote areas is not considered sufficient to justify the cost of separate management and staff for communications sales and data service sales in a vertical diversification arrangement.

(b) User Attitudes

The attitudes of users, and of potential users, of data processing services with regard to the entry of telecommunication carriers into this field, was explored by the Task Force and two other independent surveys, the results of which were made available to the Task Force. In the case of the Task Force investigations, user company executives responsible for data processing generally did not oppose the entry of carriers, mainly because of prospects for a wider choice of services and potential suppliers through increased competition.

In one of the independent surveys, carried out in October 1970, 284 responses were received to questionnaires mailed out to personnel in both supplier and user organizations. The answers to the question as to whether or not carriers should be permitted to participate were as follows:

Yes	50%
No	39%
Not qualified to answer	11%

Of those respondents favouring carrier participation, 70% favoured an arms-length affiliate, 23% offered no opinions and 7% did not respond.

In the other independent survey carried out a year later, in October 1971, essentially the same question was asked. In this case 250 responses to a total of 564 questionnaires sent to computer users in Ontario and Quebec were analyzed and the results were as follows:

Yes	56%
No	26%
No reply	18%

Of respondents who answered "yes" to this question, 69% felt that the data processing affiliate should have an arms-length relationship, 20% felt this unnecessary, and 11% did not reply.

(c) Policy Considerations

Discussion of competition policy in computer/communications must consider the two aspects — data processing and data communications — in combination. National policy should have as its aim the creation of the best possible conditions for the development of computer/communications capability in Canada for the benefit of Canadian society. In assessing policy options, the weighing of advantages and disadvantages for participation by one or the other particular industry group should always be related to the over-all national interest in the combined field of computer/communications

The principal participants in the supply of computer/communications services are the telecommunication organizations and the computer service organizations. As mentioned earlier, the main distinguishing feature between these two groups is that the former operates under regulation by federal or provincial regulatory bodies, whereas the latter operates without regulatory constraints. As a broad classification, one can therefore define the two classes: carriers and non-carriers.

Accordingly, policy options are concerned with the two following questions conjointly:

- To what extent should carriers be free to offer commercial data processing services;
- to what extent should non-carriers be free to offer services commercially, which could be considered as forming part of the data communication function.

The following table represents, in simplified form, and for the purposes of illustration, the four main policy options:

	CARRIER ORGANIZATIONS		NON-CARRIER ORGANIZATIONS	
	Data Communication	Data Processing	Data Processing	Data Communication
Case(1)	+	—	+	—
Case(2)	+	(+)	+	—
Case(3)	+	—	+	(+)
Case(4)	+	(+)	+	(+)

Legend:

+	Free to perform the indicated function
—	Barred from performing the indicated function.
(+)	Allowed to perform indicated function under specified conditions

Case (1) describes the situation where carriers are confined to data communications and non-carriers are free to offer data processing services in which all communications functions must be supplied through the carriers.

Such complete separation of functions is not practical for several reasons.

First, federal jurisdiction with regard to barring of carriers from providing commercial data processing services would not apply to provincially-regulated carriers, and provincial regulations have already, as mentioned before, permitted entry of some carriers into the data processing business. With the intermeshing of relationships between the carriers, their corporate structures, their franchises and operating areas, the barring of certain carriers, but leaving others in the business of data processing, would create complex conditions which would be substantially different in different parts of the country; and these differences would not be related to specific regional requirements.

Second, a clear separation of data communication functions and data processing functions becomes increasingly unrealistic. Switching, concentrating, multiplexing, sorting and merging of data streams can be considered as part of either function and to form part of the particular service responsibility. It will be shown in Chapter IX that the barring of non-carriers from performing certain communication functions would be ineffective and would not provide the innovation required for a healthy development of Canadian computer/communications.

As a result, if case (1) were adopted as policy, available computer/communications services would be severely constrained.

Case (2) describes a situation where the conditions of case (1) change to include data processing competition from the carriers, without removing the restrictions of communication services being made available by the carriers to non-carriers. The effect would be the gradual elimination of non-carrier data processors from the remote-access computer services market — a result which would reduce competition to that which exists within the carrier group itself (telephone and telegraph companies). Even if carrier entry into the data processing field were subject to constraints, for example, requiring some degree of vertical diversification, the non-carriers would still depend entirely on the communication services offered by the carriers, whereas the blurring of technical distinctions between computer functions and communication switching and routing functions would give the carriers a distinct advantage in their data processing operations.

Case (3) In this case, carriers are barred from data processing, but non-carriers are permitted to perform communication functions in addition to being

free in providing data processing services. As in case (1), jurisdictional problems make it unlikely that a unified approach throughout Canada could be achieved. If federally regulated carriers were barred from involvement in data processing services, while some provincially regulated telephone carriers were active in providing such services, the federally-regulated telegraph companies would be at a serious disadvantage by being excluded from the computer services field; whereas the telephone companies, because of the close working interrelationship between their member organizations, would, to some extent, be able to operate in this field.

This case presents an unrealistic alternative with severely impaired competition in computer/communications.

Case 4. In this situation, there is competition in the whole field of computer/communications (data processing and data communication combined) within the carrier groups (telephone and telegraph companies), as well as between carriers and non-carriers. In order to provide a fair basis for such general competition without placing some of the competitors in a situation where they gain unfair advantage from their other business involvements, a carefully selected set of conditions for constraints and limitations is required. This must take into account the possibilities for cross-subsidization, unfair practices, interference with the carriers' non-data-oriented operations, damage to carrier plant and other factors as covered in greater detail in Chapter IX.

Once such a set of suitable constraints is established, a situation is created in which forces and counter-forces can arise equally from telephone and telegraph carriers and non-carriers.

The constraints should provide the possibility for adequate and fair competition in commercial computer/communications in areas of high business activities, and should also provide for the availability of service from the telephone carriers to marginal commercial users and ultimately to the non-commercial home user.

(d) Recommendations

The Task Force, after consideration of the arguments put forward in the Telecommission Report 5(a), (c), (d), (e), and in light of the foregoing discussion, has concluded that it would neither be practical, nor to the advantage of the users and Canadian society as a whole, to attempt to prevent the carriers from participation in the data processing business.

Action should be taken, however, by the government to ensure maintenance of effective competition and to minimize the impact of the problems which may occur as a result of carrier participation. These problems arise from the possibility of cross-subsidization of the carriers' data processing business by their voice and message business intended to eliminate competition, and from the position of the carriers as providers of transmission facilities which may

facilitate unfair competitive practices. The independent service bureaux would be at a competitive disadvantage, not only through price, but also because of possible disadvantages in obtaining the required communications links and other services through preferential treatment by the carrier of its own data processing operation. The carrier might, for example, provide its own data processing operation with better maintenance service, advance information on new communications services, and other such plans, and might disclose information concerning carrier customers who were data processing competitors.

Constraints on carrier participation in data processing should, therefore, be directed at controlling such possible abuses. Since the regulatory authorities have encountered difficulties in obtaining adequate cost distribution information on individual carrier services, and because this problem would be compounded if data processing services were integrated with other carrier services, horizontal integration, involving sharing of management, technical and sales staff, and other facilities, does not seem to permit a satisfactory bar to possible cross-subsidization. It also does not allow for an easy identification of unfair competitive practices. This suggests that the carrier data processing affiliate should be vertically separated from the parent carrier through establishment or purchase of a separate organization with independent facilities, management and staff. Further, if the data processing affiliate were constrained from providing services to the parent carrier it would effectively remove the carriers' incentive to set up a data processing entity, by limiting its ability to obtain the benefits of a base market and of possible economies of scale, which are to the advantage of the end user. If, however, services were provided to the parent carrier, they would have to be made available to all other customers on an equal basis to prevent preferential treatment of the parent carrier and to avoid disguised cross-subsidies designed to eliminate competition.

The Task Force therefore recommends that:

Rec. 6 Federal legislation should be introduced which might serve as a model for parallel provincial action, empowering the federal regulatory body responsible for the regulation of telecommunications carrier organizations to impose conditions on the entry of telecommunication carriers into the business of offering data processing services commercially.

In particular, the Task Force has concluded that for carriers under federal jurisdiction the following set of constraints should be imposed:

Rec. 7 Telecommunication carriers wishing to offer data processing services commercially in Canada may do so only under the following conditions:

(i) That such services be offered by a separate affiliate, with officers, staff, equipment and computer facilities distinct from those of the carrier;

(ii) that all communications or other services provided to the affiliate by the related carrier must be tariffed and made available on a non-discriminatory basis to any other customer;

(iii) that the carrier may obtain data processing services from outside sources (including its data processing affiliate) save for those communications-oriented computer services which, in the opinion of the regulatory body, are integral to the operation of the public switched network; computer services, such as network switching, which are directly integral to the operation of the network should be provided by carrier in-house facilities designed exclusively for the public service obligations of the carrier;

(iv) that the carrier may purchase data processing services from its data processing affiliate, but that if it chooses to do so, it must carefully separate and identify such services, and file information as to their precise nature and cost for public inspection by the regulatory body; such costs and all transfer payments from the carrier to its affiliate or *vice versa* would be subject to regulatory scrutiny and review;

(v) that except for the restriction in paragraph (iv) above, all data processing services offered by the affiliate would be unregulated.

The Task Force considers that the carriers should not be allowed to obtain computer services "integral to the operation of the public switched-network" from outside sources. This is because such services are so vital to the public obligations of the carriers that they should be available only on a dedicated in-house basis for reasons of safety and reliability. In addition, they are so specialized, and their value is so difficult to measure, that the presence of cross-subsidization, were these services to be provided by an affiliate, would be difficult to detect. The determination of the computer services that fall within this class would be left to the telecommunications regulatory body for rulings on a case-by-case basis. The Task Force is not recommending that there be any direct regulation of the data processing service industry except, possibly, in certain special areas such as privacy. Nevertheless, it will obviously be necessary, in order to implement the above recommendations, that the regulatory body be authorized to review allegations of unfair practices by the carriers, and, if they are substantiated, to enforce corrective measures.

3. BANKS

Concern has been expressed in submissions to the Task Force with regard to the entry of banks and other financial institutions into the commercial data processing field. It was suggested in one brief from a commercial service bureau that "it would be in Canada's best interest if [the banks] were restrained from offering extended computer services to the public," although this brief recognized that, at the present time, "the chartered banks are only minimally involved in supplying computer services to the public." The Canadian Association of Data Processing Service Organizations (CADAPSO) recommended that "any regulated or licensed Canadian industry or organization whose principal activity is *not* in the field of computer services,

should be required to establish computer services subsidiaries that have an arms-length relationship." They were concerned about the opportunities which exist for cross-subsidization or "bundled marketing" which would allow regulated or licensed industries an unfair competitive advantage. Another brief, also from a supplier of data processing services, was more explicit in requesting that "The rapidly growing incursion by the Banking Fraternity into the Service Bureau Field must be stopped and reversed." The suggestion was also made that the banks might misuse their lending powers, their unique position with respect to their customers and their already available data bases, to gain an unduly dominant position in the data processing field. One submission indicated that "the chartered banks are willing to provide the services at less than cost, presumably to minimize the chances of competition becoming too well established," and in another case it was indicated that, while the service bureaux' basic price structure was lower for a payroll system, the ability of the banks to wield influence through relief from service-charges, additional allowances based on the increased float available to the bank, and the persuasion that can be applied by a branch manager, could result in rejection of a private service bureau proposal.

The banks have been unanimous in their responses to the Task Force in stating that it is their firm policy to ensure that every service offered will be independently profitable. If their intention is put into practice, the prices of their services, including data processing, would not be subsidized by other services. Lower prices than those charged by competitors would in this situation result from possible economies of scale and efficiencies of advanced systems. Such economies are, of course, advantageous to customers and cannot be classified as unfair competition.

The Task Force has examined the need for restraining entry of the chartered banks into commercial data processing. The chartered banks already operate under restrictions imposed by the Bank Act which at present permits them to "engage in and carry on such business generally as appertains to the business of banking" (section 75(1)(e)), but which also includes the proviso that a chartered bank shall not otherwise, directly or indirectly, "deal in goods, wares and merchandise or engage in any trade or business," (Section 75 (2)(b)). The Task Force has therefore concluded that, provided the banks limit their data processing offerings to "banking related services", supplementary to such activities as acquiring, dealing in, discounting and lending money and related services as stated in the Bank Act, they should not be subject to any restrictions on entry into the commercial data processing services business.

The Task Force is not satisfied, however, that the terms of the present Bank Act adequately define the areas where the banks may freely offer data processing services and accordingly recommends that:

Rec. 8 Chartered banks should be permitted to offer data processing services to the general public in Canada, subject to the following conditions:

(i) that such service should be directly related to the business of banking; and,

(ii) that the Bank Act be amended to provide the mechanism whereby interested persons may obtain rulings, from the Inspector-General of Banks for the administration of the Act as to whether any particular service is within or outside the meaning of (i) above, and that the banks would be bound by such rulings.

The Task Force does not underestimate the difficulty of defining precisely which services fall within the terms of the Act, since these services are evolving. A mechanism for obtaining case-by-case rulings is, therefore, essential without necessarily placing prior restraint on them by defining the boundaries in advance, and thus preventing the emergence of a service which may be of great value to customers.

4. UNIVERSITIES

The Task Force has been concerned with commercial computer services offered by universities. Computers used by universities are exempt from federal sales tax and import duty and are made available to them and other educational institutions by some suppliers at a discount price. In the latter case they are required to rebate the portion of the discount applicable to the time that the computer is used for commercial services. In addition, the university computing centres generally receive funds for their space, power, operating personnel, supervision and telephone charges out of the university budgets. The federal government, under a federal program started in 1966, subsidized about 50% of the $1.5 billion operating expenditures at post-secondary institutions during 1971, in the form of tax transfers and equalization payments. This means that, indirectly at least, a part of the university expenditures on computing is supported by federal taxation, and most of the rest from provincial taxes. In addition, NRC provides money through grants either directly to the computer departments or indirectly through research awards.

The total revenues received by the universities from commercial services were in excess of $1.2 million in 1970/71 or about 2% of the total annual cost of their computer operations. Most of the revenue is derived from over-the-counter service bureau operations, time-sharing services for computational work and remote job entry (RJE). One of the major groups of users consists of members of the Financial Research Institute (FRI) which uses the university computing centre at McGill University. FRI supports what is probably the most highly developed financial data bank in Canada and makes available services for financial and economic analysis and portfolio management to its members, through terminals linked to the McGill computer. The members of FRI are banks, brokerage houses, trust companies, insurance companies, mutual

funds, government institutions, industrial firms and universities. Other institutions which use university computers are hospitals, libraries and governments.

Although the commercial revenues of universities from computing activities represent only about 1.5% of the revenues of commercial service bureaux in Canada, service suppliers have expressed great concern regarding the apparent increasing trend towards service bureau operations by the universities. While CADAPSO, in their brief to the Task Force, recognized that total prohibition of the universities from engaging in commercial be unwarranted, and acknowledged "the beneficial contribution of university computing centres", they believe that "their continued existence as a commercial competitor can no longer be justified at the expense of undermining the growth of a broadly-based Canadian Computer Services Industry." They point to the recently announced offerings of remote job entry service by universities, other than McGill, in the Montreal area as illustrations of the increase.

From the universities' point of view, the commercial services offer a means of absorbing a portion of their costs at a time when they are under greater financial pressures than in earlier years. Time-sharing and remote job entry are frequently part of the capability of the university computer for internal university usage and the universities claim that extension of the services, by placing terminals in private businesses and other institutions, can be done without great additional effort.

An alternative approach for reducing the cost of university computer operations would be by centralizing or co-ordinating the computing facilities of a number of universities. Efforts towards this end are now in progress in a number of areas.

In many instances, the services the universities provide present a unique solution for satisfying needs which arise when either regional conditions of the computer industry or a highly specialized program of research and development make the provision of required facilities by commercial data processing bureaux uneconomic. The universities have developed data banks for special analyses and others for reference purposes, such as legal information services, surveys, mapping and land titles, soil data, archeological sites and museum holdings. In addition, the University of Waterloo's WATFOR and WATFIV compilers have received wide acceptance. The University of Western Ontario is planning to market a geological data storage and retrieval system with the acronym of SAFFRASS. Development of these systems and data banks provides a vehicle for the training of computer technicians, programmers and analysts, and, on occasion, results in program packages which are of wide general applicability and use. If the results of this work are not made available in the public domain, the product of tax-supported efforts would be lost.

The Task Force, however, considers that organizations which are subsidized by government funds or exempt from taxes should not take advantage of their position in a competitive situation.

Accordingly, while the Task Force does not presume to interfere in the universities' rights of administration, it is recommended, in the interests of maintaining a healthy development of the computer service industry that:

Rec. 9 Universities, in the consideration of providing commercial data processing services to outside customers, should be strongly discouraged from taking advantage of their privileged position (which arises from their publicly-supported operating budgets, tax exemptions and grants), in areas where services are available from other sources. However, this policy should be sufficiently flexible to allow universities to employ excess capacity (over and above their primary teaching and research commitments) in special cases where commercial operations from outside sources are not filling the need.

5. CROWN CORPORATIONS

Some Crown corporations, both federal and provincial, are actively involved in the provision of data processing services as commercial ventures. Of the federal Crown corporations, Canadian National, with a 25.5% interest in Computer Sciences of Canada Ltd., and Polymer Corporation, with a large interest in Comshare of Canada Ltd., are the present participants. Air Canada has expressed the intention of providing commercial services in connection with its reservations system. Provincially, Crown corporations are providing, or are about to provide, commercial services in Newfoundland and Manitoba.

Only a very small number of respondents have taken exception to the provision of commercial data processing services by Crown corporations. The opposition to Canadian National's activity in this field, for example, has centred upon its rôle as a communications carrier, rather than upon the fact that it is a Crown corporation.

In general terms, Crown corporations are normally initially formed to perform functions or to provide services which the private sector is unable or unwilling to furnish. To the extent that a Crown corporation's diversification from its prime function encroaches upon the market already served by the private sector, it would clearly intensify the level of competition. In such situations, Crown corporations should not receive any special consideration from government if they enter the data processing service industry. Should they choose to do so, their continuing presence should be assessed on the basis of the economic viability of the services offered as a self-supporting entity. However, there may well be special circumstances where the requisite services are not furnished by the private sector, and where a Crown corporation or some other government institution would be the only means of ensuring their provision. These special circumstances might include: the lack of service in a remote geographic region where the market is too sparse to be profitably served; or where a data base intrinsic to the corporation could not be maintained or offered for commercial access by the private sector.

6. COMPUTER EQUIPMENT SUPPLIERS

Relatively little computer hardware is manufactured in Canada and the suppliers of computer equipment are, for the most part, Canadian subsidiaries of U.S. companies. These suppliers also operate commercial data service bureaux in Canada. Since their main business function is the supply of equipment, their service bureaux usually exist primarily as an adjunct to the marketing operation. In this manner, for example, the supplier can provide service to a client whose requirements are too small to warrant an in-house system, or who is in the process of conversion to a larger system, or who has a specialized requirement.

Six major suppliers operating service bureaux command about 30% to 50% of the data processing services market in Canada. IBM, the largest member of this group, operates a "network" of some 23 service bureaux across Canada which provide various over-the-counter and teleprocessing.

Independent service bureaux — those which are not controlled by suppliers — are themselves important customers of the suppliers. It is indeed likely that the independent bureaux have even helped to develop the hardware and software market by the introduction of new services.

It appears that the strategy of the hardware suppliers at this time is aimed primarily at developing the equipment market and that their activities in the data services field are part of this strategy. Moreover, practices which might occur, and which would restrict competition or impede development of the data processing industry, as a result of the suppliers' presence in the services field should be remediable under general competition legislation. The Task Force therefore believes that at this time restrictions on the activities of hardware suppliers in the data processing field are not justified but that the situation should be monitored by government so that if trends emerge which may impose restraint on competition, they can be identified.

Chapter IX
Data Communications

The basic Task Force approach to policy developments in the field of data communication services was described in Chapter VI. It centers on the two main concepts of fostering a competitive and innovative industrial environment, and maintaining a strong presence by government in defining the conditions under which industry must operate to the benefit of society. These policies are expressed in the form of the following broad Task Force guide-lines from which specific recommendations are derived:

- Government should assume a co-ordinating role in the planning and gradual implementation of a coherent data communications network aimed at providing the flexibility, variety and cost-effectiveness required for distribution of computer services throughout Canada and for compatibility with foreign computer networks.
- In the interest of stimulating innovation in the provision of data communication services, competition between existing common carriers should be encouraged, and independent entrepreneurs should be permitted to supplement common carrier services. However, the technical and economic integrity of the public switched-networks, in particular the present telephone voice network, should be protected.
- In order to ensure the orderly growth of a coherent data communications network, government should take steps to avoid the proliferation of incompatible terminals and data networks providing commercial services to customers.

The following sections deal with the various aspects covered by the guide-lines and lead to specific recommendations.

1. DATA COMMUNICATIONS AND THE USER

(a) User Attitudes

Over the past few years the use of common carrier transmission facilities for data communication has become an increasingly important part of modern computer systems. Communication facilities are used both for off-line information transfer with no direct computer connection, (such as magnetic tape to magnetic tape) and for on-line terminal-to-computer and computer-to-computer connections. Data can be transmitted over the switched (general) telephone network at speeds up to about 1200 bits per second and over specially conditioned facilities at speeds as high as 50,000 bits per second. The Task Force visited a number of major corporate users of data communications services, including computer service bureaux, in order to identify technological, economic and operational problems encountered in existing data transmission services offered by the common carriers, and to project future requirements.

From a list of approximately 150 large corporate data transmission users, 60 were selected to be interviewed, and of these 51 responded fully or in part. These 51 provided as wide a geographical representation as possible, and included a representative sample of the various industrial and business sectors (governments were not included). As far as can be determined, the present level of data communications expenditures in Canada is approximately $120

million per annum. This sample accounts for nearly a fifth of that expenditure. The following paragraphs give a brief summary of the findings from this survey.

Expenditures for data transmission services for an individual user range up to more than $200,000 per month. Subscribers are utilizing the service offerings of the carriers including Data-Phone, Data-Line, Broadband Exchange Service, Multicom, private line data channels, multiplexers, and foreign exchange circuits conditioned for data use. Regular services such as telephone and Telex are also being adapted for this purpose.

The public network as used for low-speed services was recognized to have the well-known deficiencies of long call set-up times, high error rates in some cases[1], and disparities of services between regions. Dedicated circuit facilities were said to take too long to "tune up". The rentals charged by the carriers for data sets and multiplexing equipment or, alternatively, the services which replace them were so costly that users felt obliged to purchase their own equipment or at least seek other suppliers. Users moreover expressed a need for more liberal rules on interconnection between different carriers' systems and private ones. Interconnections were held to offer the promise of wider choice of suppliers and more flexibility in services; wider geographic access; alternate routing for back-up; and reduced costs through sharing.

Questions were also asked regarding present and possible future network characteristics and services. These included items such as automatic origination and termination of calls, two-way simultaneous transmission, code conversion, and speed and code independence. A majority of respondents said that in any future data communications networks, code and speed independence would be essential. Some respondents felt that code/speed conversion would be desirable in such a network. This latter feature is available only in specialized (and expensive) services offered by the carriers, or in customer-designed private-networks. Other questions dealt with network integrity, use of alternate voice, error rates, signalling conventions and other characteristics, all of which are now the subject of much study and discussion by technical bodies throughout the world.

A majority of respondents use, or plan to use, data communications equipment from suppliers other than the carriers. At present interfacing this equipment with carrier facilities can result in operational problems of system-design and maintenance. This is attributed in the first place to an absence of published technical specifications for carrier facilities. Users in general want technical descriptions and specifications for carrier facilities to be as available as those of suppliers of computers and terminal equipment. The absence of specifications results in ill-defined interfaces, and the responsibility for tracing troubles cannot easily be assigned to either the carrier or the computer supplier.

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[1] *Communications, Computers and Canada* (Trans-Canada Telephone System November 1971 revised December 1971) p 24

There was a general feeling among users that rates are too high, so that many feasibility studies for new systems were being deferred. The majority of respondents view data communications as a commodity with elasticity of demand.

There was substantial criticism of carrier marketing services, and of the manner in which data communications services are described. Information from different sources within TCTS, for example, was said to be inconsistent.

Under-utilization of circuits was considered to be a major problem. In many situations users are leasing facilities which are under-utilized, but which must nevertheless be paid for as if they were fully utilized. To offset this, users would like to share communications facilities by collaborating directly with other users, so as to increase utilization and thereby reduce unit costs. Seventy-five per cent of respondents favoured line-sharing arrangements to serve this purpose.

Finally, while a majority of users would like to see a wider variety of facilities and services offered by the carriers, they recognized the economic problem of adapting common facilities to a multiplicity of varying user demands.

In addition to carrying out the survey mentioned above, the Task Force also received many position papers from data communications users. These generally reinforced the observations summarized above. To avoid repetition, comment is offered only on items throwing new light on data communications problems. Interconnection, according to some users who submitted briefs, is not to be confused with intercommunication. Users of dedicated data lines do not, at the present time, wish to communicate with one another to any significant extent; rather they want to reduce their data communications costs and improve the quality of the services obtained.

Additional difficulties arise from such factors as, for example, incompatibilities between U.S. and Canadian terminals on a CN/CP Tel link with Western Union, which entails the use of two terminals instead of one and a relay operation on the Canadian side. Need for a responsible body to review interface problems was stated clearly. Also, there is a common requirement to combine voice and data for set-up and control of a data service. Users of CN/CP Tel services commonly complained of the lack of supporting voice circuits.

Airlines and other organizations offering reservation services are especially concerned with international as well as domestic communication services. They would like greater flexibility in network structure, and in tariffs, in order to utilize their facilities fully.

(b) Restrictive Tariffs

The great majority of users expressed the opinion that tariffs, as written and applied by the common carriers, are restrictive and continue to be a serious impediment to the development of data communications in Canada. To the

less sophisticated users, tariffs equate only to rates, and the statement that "rates are too high" generally means that no economic benefit derives from the addition of data communications to a computer system. Operators of larger and more sophisticated networks consider that the technical restrictions implicit in the tariffs, which limit application of user-owned equipment and of new technology, are more serious than rates.

Some appreciation of the situation may be obtained from the wording of actual tariffs, excerpts of which are presented in Appendix 2. The words of course reveal nothing about the administration of the tariffs by the carriers. Many users cited their frustration in attempts to obtain more information about tariffs. Since tariffs are originated by the carriers, and in due process filed with regulatory bodies, they are not at all static, and in fact are a running reflection of the interplay between the carriers and users. The tariffs quoted in Appendix 2 relate to the interconnection of customer equipment or to possible arrangements the user might wish to make in order to multiplex or concentrate, to reduce costs, or even to re-sell. These are perhaps the greatest areas of contention. The selection of the tariffs does not imply any opinion of the Task Force as to the relative positions of the two carriers with regard to use of tariffs. Editorial comments and underlining have been added.

Carriers introduce new services after the necessary internal organizational preparations, by writing or re-writing appropriate tariffs. From their special knowledge and use of the infrastructure of tariffs, the carriers can write tariffs to meet competitive situations. They are also readily able to relate tariffs for communications links, terminals, and data sets into a single "package" for bidding purposes. The resulting offer is frequently for lease rather than sale of the peripheral equipment (notwithstanding the fact that the necessary capital comes from general funding sources of the carriers). There is, moreover, no obligation on the carriers to publish a breakdown of the package cost structure. One of the briefs offered to the Task Force by a supplier of computing equipment and services noted that the carriers occupy a privileged position with respect to their competitors in bidding for such package systems. While all computer communications suppliers need to reveal, at least partially, their plans to the carrier to obtain specifications and prices for communications services, the carriers are under no obligation to make similar disclosures to their customers. The carriers are able, moreover, to create new tariffs — related to custom made services — to suppress the competition. Wider dissemination of carrier tariffs is needed, but the increasing variety of service requests will result in continuing deviation from existing tariffs, and publication of the latter, while necessary, will not be sufficient for the users' purposes in many cases.

(c) Rate Considerations

Distance, as a factor in the rate structure, has been diminishing in importance, since transmission costs have been dropping and exchange and local costs rising so as to reduce the proportion of transmission costs to total costs. The number of circuit break-out points and the population size served by each point have increased to produce this effect. The new satellite

technology is an extreme example of a case where transmission costs per mile are virtually meaningless and, with the exception of the satellite itself, all costs are actually related to break-out points (ground stations). Elimination of mileage as an element of rate structure does not imply a reduction of total plant costs or of rates to the average user.

Rate structures for voice could be based upon the assumption that the class of service was uniform in technical characteristics. With data communications there are many combinations of technical parameters at the command of the user. The parameter of speed alone can completely change the class of service, its cost and availability. In addition, interconnections which would be necessary for extended distance-independent rates assume special significance.

In the Task Force investigations of user requirements relating to rate structures and other problems associated with the provision of data communications services, very few of the 45 responding data communication user organizations said that they would prefer a ''flat rate'', whereas about half said that distance should remain a factor in the rating structure. About half the respondents also suggested that volume (rather than holding time) should be a factor.

There was no evidence of a strong demand for distance-independent rates, perhaps because such rates are by no means necessarily low. However, there may be specific cases of services which are confined to communities of interest (*e.g.*, travel agents, stock-brokers, or community information centres), which have a large number of geographically-dispersed users, for whom administrative cost-savings could result from establishing rates in which distance is a minor element.

Tariff structures are complex and the expertise in their formulation and understanding still rests with the carriers. Some attempts have been made to reduce the impact of distance on rates by the introduction of ''zoned-rate'' services, such as DATA LINE II and Telex Computer Inquiry Service.

In discussions with representatives from less industrialized regions, concern was expressed on the possible socio-economic effects which could result from general distance-independent rates. Computing services could become centralized in a few locations in Canada, thereby reducing the computing capability in more remote areas.

In the light of these uncertainties, the Task Force has come to the conclusion that distance-independent rates should be considered at this time only with regard to specialized services for communities of interest and possibly for regional zones.

The Task Force therefore recommends that:

Rec. 10 Policies in network development should be oriented, in consultation and co-operation with the provinces and the private sector towards achieving rates for specific services in which the controlling factors may include time, bit rates or other parameters of network utilization but in which geographical distance is of minor or no influence, particularly within regional zones.

The Task Force considers that regional interests, the state of the art, the yet unachieved transition from voice structured tariffs to those more suited to data communications, and the complexities of network cost distribution all combine to push the realization of generalized national distance-independent rates for data communications into the future.

A frequently-used point of comparison is the rate for data communications services in Canada and the U.S.A. This comparison is made with respect to services being offered by the telephone systems. It has been noted earlier that the characteristics of data services are complex compared to those of voice services. Therefore it is not possible to develop a common scale of values to users. In fact, the only chargeable feature of telephone service which may have value to both data and voice users alike is distance; even this is in dispute and it is in any case unlikely that both types of users ascribe the same dollar value to the same unit of distance. Assuming that the technical characteristics of generalized communications services of the Canadian and U.S. carriers are uniform, a rate comparison may be made by comparing unit prices which, in the case of long-distance telephony and private-line service, vary according to mileage.

- Long-distance Telephony — The rate per mile (for a call of given duration) in Canada varies from slightly less than the U.S. rate (about 80%) to more than double the U.S. (about 225%) depending upon the mileage. The lower the mileage the more favourable is the Canadian rate relative to the U.S. rate. Comparisons are based on interprovincial long-distance calls in Canada and interstate calls in the U.S. and such calls are presumed to be "station-to-station, customer-dialed, business day".
- Intercity private line — The rates for voice-grade dedicated (private) lines in Canada vary from 50% to over 200% of the comparable U.S. rates, again depending upon circuit mileage. The Canadian rate is approximately 175% of the U.S. rate, on average.
- TELEX — The Canadian per minute rate for TELEX service averages approximately 150% of the comparable U.S. rate, again varying with distance.
- WATS/INWATS — These are forms of bulk long-distance telephone service which have proven to be of considerable interest to data communications users. Because service is purchased by "zones" for a fixed monthly charge a price-distance comparison is meaningless. The maximum monthly charge for this service in Canada is $3500 versus $1900 in the U.S.A. The minimum monthly charge (for full-time service) in Canada is $1750 versus $500 in the U.S.
- Data terminal equipment — Carriers in Canada and the U.S.A. offer, for monthly rentals, items of communications-oriented terminal equipment which, in conjunction with a generalized communications service, may be configured into a data communications service. A common example is Data-Phone, a combination of terminal equipment with telephone service. The rental rates for such items of equipment leased from the carriers in Canada vary from near parity with the U.S. rates for certain high-volume items to three, four or even five times the U.S. rates for items such as medium- to high-speed data sets, tape terminals and printers.

The cost of data communications in Canada through generalized communications services is generally higher, by a significant margin, than it is in the U.S. under comparable circumstances. However, the differences result partly from the different relative distribution of rates (long/haul versus local) that exists between the two countries and which arises from different regulatory and administrative philosophies. Furthermore the causes of these differences are to be found in such factors as population density, over-all size (distances spanned), population distribution, and aggregate population, all of which are, of course, markedly different in the two countries. These factors all have a bearing on all communications costs and the details of their influence have been examined by the carriers in their submissions to the Telecommission.[2] Approximately three-quarters of respondents to queries from the Task Force viewed data communications as an elastic commodity, *i.e.*, that lower prices would result in more use. The others view their own demand for data communications as substantially independent of price. The carriers also agree that there is some elasticity but have yet to be convinced that it is significant. Probably the best approach may be an experimental tariff reduction. The carriers are asking for more freedom to experiment in this area.

An avenue of improvement is to use data sets operating at the highest speeds consistent with acceptable error performance. Another is to use multiplexers which make possible the use of single circuit transfer of several streams of low-speed data which might originate with different users. Recently, data concentrators have been introduced to more efficiently pre-form the data before multiplexing. Hence, it is technically possible for two or more users whose individual demands are low to band together to increase the utilization of a private-line network.

In summary, the disadvantages to Canadian users of data communications, relative to their U.S. counterparts, can to some extent be overcome by taking advantage of the present unused capacity of communications facilities which can be used for data.

2. COMPETITION AND INTERCONNECTION

Computer/communications and data communications are in early development stages, and it will be important for Canada to establish the correct balance between the factors leading to monopoly, and the alternative economics of a competitive environment. In addition to competition between themselves, the carriers now have to deal with competition from non-carrier organizations which are computer-industry-oriented. Competition issues frequently emerge also as interconnection issues. Several forms of interconnection will be reviewed as they relate to competition, and to compatibility between data communications systems.

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[2] Department of Communications *Telecommission Study 2(a) The Canadian Telecommunications Industry Structure and Regulation* (Ottawa Information Canada)

(a) Competition Issues

Competition Between TCTS and CN/CP Tel

The competition between these carriers is one-sided according to briefs submitted to the Telecommission by CN/CP Tel.[3] Essentially, they claim that their capital base is too small and that this is due in part to a lack of a profitable class of monopoly service. The public telegraph service is not profitable. Additionally, they are seriously hampered by lack of local distribution systems; by restricted access to those of the telephone carriers; and by the impermanence of their agreements with the telephone carriers. Consequently, in these submissions, a request is made for a monopoly of switched record services below 600 baud. They also request the right to acquire local distribution facilities from the telephone carriers and to interconnection from their dedicated circuits to public switched distribution systems.

Currently data communications account for only 3 to 4% of the revenue of the TCTS organizations. CN/CP Tel obtain nearly 60% of their revenue from data communications if TELEX is included. The TCTS has made an interesting comparison of the volume of data traffic compared to voice traffic both at present and projected to 1980. The TCTS analysis, which is based on actual traffic figures in bits per month, states that:

"Although a person speaks at the rate of perhaps 50 bits per second...an individual's voice is encoded at somewhere between 2,400 and 60,000 bits per second, primarily due to redundancy in the human voice. If telephony were equated at 50 bits per second the ratio of telephone to data traffic would be about 25:1 instead of 1200:1 (The value which results when voice is equated to 2,400 bits per second). Hence, on the basis of holding times or revenue, about four per cent of the total business today comes from data traffic. By 1980, the ratio would be 6:1, or about 17 per cent of the total business."[4]

While the purpose of this analysis is to indicate that data forms a relatively small portion of the traffic load it is obvious that the portion of revenues is not equally small. Indeed it would appear that data is about 50 times (*i.e.*, the ratio of 1200 to 25) as productive of revenue as is voice traffic. This is a considerable premium for data communications users to pay for use of a common network. The forecast may not be realistic because it is based upon the assumption that the present voice-oriented rate structures will continue to apply for data communications services. While this is unlikely, the fact is that the business community has to date seemingly accommodated, within its overhead structure, a high cost multiplier for charges for data communications. It appears possible that significant changes can be made in data communications costs and network technology.

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3 Department of Communications. *Telecommission Study 8(b)(ii) Interconnection Between TCTS and CN/CP Telecommunications* (Ottawa Information Canada)

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4 *Communications, Computers and Canada op cit* p 23

Data communication rate structures have evolved from voice structures. As a result, the majority of data communications charges are related to those for voice communications which incorporate the basic voice service philosophy of rate-averaging.

Rate-averaging is an arrangement wherein prices are adjusted so that total costs of providing telephone service are recovered from total revenues, even when there are large differences in the cost of providing individual service. Rate-averaging has ensured that most individual householders can afford to have access to the telephone networks.

The voice monopoly has arisen from an over-riding social demand for a telephone in every house. Voice (telephone) service is indeed a public service, *i.e.*, one wherein any subscriber can call any other subscriber; it is nominally available to all who request service, and is in widespread use by all members of the public. Thus, there is sufficient reason to support this monopoly system which extends services on the broadest possible base at acceptable rates for all. In the diagram of Fig. 2, (Part A, Chapter II) the monopoly base for the telephone carriers comprises the private residences in which are installed 6.5 million telephones.

At present, data communication services do not have the characteristics of a public service. As shown in Fig. 2, data services, in contrast to voice-system development, are developing from the apex of the triangle, representing sophisticated special services, downwards to the base at which telephone services are provided under monopoly regulation. However, corresponding conditions in the data field for which the need for monopoly regulation would become evident, do not yet exist and are not likely to exist for a number of years. The bulk of data services today consists of dedicated, private-networks leased from the carriers. Service organizations offering remote job entry or point of sale and other computer/communications services to the commercial public are still relatively novel. Thus small business organizations constitute markets which are as yet largely unpenetrated.

Data communications for industry and commerce have developed from the low speeds (less than 1200 bits/sec) to a penetration of medium speeds (less than 9600 bits/sec). At medium speeds, data circuits are functionally separate[5] from voice circuits, (*e.g.*, the TCTS Multicom system). The movement into medium speeds will become important in this decade. More technical separation of voice from data traffic can be expected. Moreover, TCTS have disclaimed any monopoly obligations for present commercial data services. It follows, perhaps, that at least the separable data services operating above 1200 bits/sec can be expected to develop in a competitive environment.

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[5] A "functionally separate" system is one in which some elements, particularly switching components are separate for voice or data use while other elements in the system particularly transmission components may be common

At the same time, data transmission below 1200 bits/sec may well be suitable for the marginal user, the small business man and ultimately the home-owner. This will require the widest possible switched base and may be expected to utilize the telephone network.

The use of carrier facilities for public- and private-network services means that the issues of monopoly, competition, and interconnection cannot be treated separately.

CN/CP Tel, in spite of their difficulties related to use of the telephone network, have managed to secure approximately half the data communications business in Canada, if one includes switched message services like Telex. If the size of CN/CP Tel, in terms of capital investment, does not change in relation to the TCTS, then the former will be unable to support data services offering marginal returns (without a subsidy). On the other hand, with full interconnection of CN/CP Tel facilities to the telephone network, such services could be selectively extended to areas now served by telephone. The argument is therefore that, ignoring cost-imposed limitations, such interconnection, in conjunction with the requested monopoly for switched record and data services to 600 baud, would give CN/CP Tel the opportunity, of developing a selective monopoly of low-speed data and message without the obligation of rate averaging (unless government intervened). Such a monopoly would put pressure on the economic mainstays of the telephone system and would inhibit development of data services for the small user and for those users who will be dependent upon the existence of a universal public switched-network with natural monopoly characteristics.

This is the main issue underlying extensions to the interconnections between the telegraph and telephone carriers. These relationships are a major determinant in establishing a line of demarcation between competition and monopoly in data communication.

Government has the option to encourage the development of competitive medium and higher-speed services by supporting CN/CP Tel in securing specific agreements covering price and technical factors for interconnection of their systems with those of TCTS. This would necessarily be an on-going activity as the two systems expand to meet demand. For example, different regions in Canada will tend to develop local data services in their own time-frames. Different economic needs and therefore different service requirements can be expected. There will be special problems associated with the interconnection to regional systems of non-telephone carrier transcontinental networks, such as those of CN/CP Tel (and Telesat), since provincial governments in some cases own and operate the telephone systems. Toll revenues from long-distance data communications could become a controversial subject between the ''national'' and provincial carriers. Hitherto interconnection has been arranged on a sharing basis by the telephone carriers.

Mandatory interconnection, if required between provincial carriers, CN/CP Tel (and Telesat) would affect the TCTS toll revenue distribution practices. Further,

since the railways hold rights-of-way from coast to coast, they may eventually develop a strong position regarding division of tolls if cable and waveguide come into common usage. Therefore agreements between TCTS and CN/CP Tel may be difficult to achieve.

From the foregoing, the Task Force concludes that a government presence will be required to ensure the development of data communications services using the monopoly-oriented switched-voice network, and concurrently of competitive with improved performance.

The Task Force accordingly recommends that:

Rec. 11 Government should take steps through the Focal Point, in consultation and co-operation with the provinces, to ensure the evolution of data communications networks which in part are functionally separate from the telephone network, with the aim of having improved technical and economic service characteristics provided.

Competition — Carriers Versus Computer Industry

There is no direct competition in Canada analogous to that in the U.S. where University Computing Corporation, through their subsidiary DATRAN, has achieved status as a special carrier, to offer data services over an all-digital national system. However, the pressure from the computer-related industries upon the common carriers is very real. It stems mostly from the fact that the user owns data communications equipment which is part and parcel of a computer facility, integral with his business process. Also, the business user is in frequent contact with representatives of the computer industry because of his requirements for business machines and supplies. With the introduction of the front-end processor concept for data communications by the computer industry, the user now has an owners' interest in techniques for code conversion, store and forward, and most important in a certain switching capacity. TCTS has reacted under these pressures, and in one instance the reaction was to contract with a computer organization for the supply of equipment to use as a base to develop a new front-end controller system.[6]

The carriers, desirous of broadening their rate bases and of diversifying their service portfolios, are clearly making concerted efforts to exploit data communications equipment to the full. It appears unlikely at present, however, that they will fully control this aspect of the business, as they do in telephone equipment, where all phases of the operation, back to manufacturing, are largely under the control of the carriers.

Regardless of the agencies providing data communications, the government needs to be very active in encouraging Canadian procurement. This is evident

[6] Krupski H quoted by Blagg M "Ottawa labs give Canada a world lead in Communications", *Ottawa Citizen* September 14 1971 p 10

from the fact that, for example, large international firms are the most likely sources of supply for digital switching equipment. Western Union in the U.S.A. have already placed orders for the German EDS digital switch. Such switches will form a large part of the investment in any digital network. CN/CP Tel estimates that $50 to $100 million for an initial national switching complex will be required. (See Appendix 3)

Will the necessary capital be furnished by the carriers, by the computing industry, or by some new combination? This must be one of the areas of concern by government because the rate base of the telephone carriers would be affected by a shift of capital allocation within the telecommunications industry.

Non-Carrier Organizations and Competition

Comparison of user submissions to the Telecommission with current submissions to the Task Force indicates that progress in resolving data communications problems has been slow during the past few years.

It is evident that the leadership for innovation during the period has come as often from the users as from the carriers, and if computer/communications are to achieve fulfilment in Canada, the barriers which have been maintained by the carriers around their "monopoly" plant in some cases will have to be lowered to non-carrier organizations. Users and entrepreneurs will have to be given participatory rights in the development of Canadian data communications networks.

For several years the experience of business managers has been that their systems analysts were not successful in relating their computer technology to the business in hand. Little wonder that the common carriers have been under fire for not relating their network facilities to their customers' data communications systems requirements. The problem is complex, but user representations to the Task Force indicate that the carriers are not providing leadership for data communications systems specifications, even to the extent of providing an adequate base of technical information about their own systems to aid users.

It is important that the services provided by the carriers be fully specified and published, in order to minimize pricing and technical problems related to system interconnections or use of non-carrier-owned attachments. Similarly, those technical precautions which the carriers consider essential for protection of their networks from interference or damage should be clearly expressed to all users. On the other hand, non-carrier organizations must expect to be bound by the specifications and standards as set out by the carriers for the use of their facilities. They should also be encouraged to comply, as far as possible, with published network standards in order to avoid the proliferation of incompatible networks.

The Task Force recommends that:

Rec. 12 A non-carrier organization leasing facilities from a carrier should be permitted to attach to those facilities any data communication equipment not owned by carriers, provided only that it meets published standards for continued protection of the carriers' networks from damage and interference; such an organization should, however, be encouraged to adopt published data network standards wherever possible.

Line-Sharing and Re-Sale

These terms are not synonymous in the view of the carriers and therefore some definition is necessary. ''Line-sharing'' will be considered here in the sense of customers making common use of a line, each for his own private interest and with some provision for sharing the cost. ''Re-sale'' will be interpreted as the use of a private line or lines for collection, delivery and transmission of communications for others with the express purpose of profiting by so doing. It is anticipated that services which use computers for such collection and delivery will become complicated to the point where they will be performing message-switching or other special functions. But as long as these are incidental to the sale of the computing service, the whole will be regarded as a computer communications service or ''hybrid'' service and not as a ''re-sale'' service. Examples of this in practice are the computer-based enquiry services of brokerage firms.

Voice-systems usage is characteristically random. Not many calls can be scheduled, nor is it economical to store and concentrate voice messages in the concept of time division multiplexing, which is now being proposed for digital data communications. This technology opens up new possibilities for line-sharing. It makes even a few moments of otherwise idle time on a data circuit valuable. However, to be able to accomplish this, new equipment is required. Large corporations will be able to provide their own, but others will have to rely on the carriers or on entrepreneurs prepared to put up the capital to acquire the equipment and to organize computer/communications systems.

Generally, the carriers may be expected to modernize their plant to supply such new facilities and systems. The rate at which they do so, however, will be largely dictated by the availability of capital and by its apportionment to data or voice needs. Furthermore, in the more sophisticated forms of computer/communications, the problems to be solved may be fundamentally those of computer systems software and hardware rather than of traditional communications engineering. It is at least plausible that computer industry firms would excel in this situation. In the long run, one would expect that, to the extent that there are economies of scale in such operations, the carriers should be able to perform line-sharing of data communications at the lowest cost and to the satisfaction of most users.

The front runners of non-carrier groups offering new services are those which propose to lease circuits from the common carriers for re-sale to their own customers. Use of additional equipment is planned by these entrepreneurs to

provide new services to their customers, such as new forms of line-sharing and improved end-to-end quality due to new error-correction and detection techniques.

The wording in the selected tariffs in Appendix B suggests that carriers restrict line-sharing and re-sale because they consider them as forms of competition. The subject is an important point of current controversy between carriers and non-carriers. The Task Force has concluded that, at least in the short-term, a policy for liberalization of line-sharing and re-sale would result in advantages to users, both in reduced communications costs and improved service quality; and also that there would be synergistic increases in usage of carrier facilities which would result in over-all benefits to carriers and non-carriers. The Task Force therefore recommends that:

Rec. 13 A non-carrier organization (including data processing affiliates of carriers) may offer commercial data communication services to customers through carrier facilities, subject to filing with the regulatory body prior to initiation of service, information on its corporate structure and its data communication services; and the regulatory body should be empowered to conduct hearings which may result in the services being disallowed on the grounds of failure to comply technically with published network specifications and standards, or of economic infringement of the common carriers' regulated public switched-network services.

Responsibilities of the Carriers

The carriers enjoy a basic protection for use of rights of way for the public telephone and telegraph services. Certain data services, because they are functionally separable from these public services, can be made competitive without removing this protection. As long as non-carriers do not construct their own transmission facilities, this competition will be limited to various forms of derived services. The monopoly services of telephone and telegraph will continue to require regulation.

However, all that has been said to this point should make it clear that a new rate structure for data communications must be devised. Thus, both data processing affiliates of the carriers, if created, and non-carrier organizations could expect common rates for communications services using criteria different from those used for telephone. Moreover, while the telephone and telegraph monopolies will be retained, there will be scope for competition in data communications services.

In order to ensure that all users, including commercial computer/communications entrepreneurs and the data processing affiliates of carriers, have access to the data communications services of the carriers on an equitable basis, the Task Force therefore recommends that:

Rec. 14 Carriers should be required by legislation to file with the appropriate telecommunications regulatory body, specifications and charges for data communication services; and the regulatory body should be empowered to approve such specifications and charges; and to require publication of them.

Furthermore, the regulatory body should be empowered to prescribe the form, content, and frequency of carrier returns accounting for expenditures, the form of submissions relating to equity issues, and other particulars in support of their tariff submissions.

The Task Force recommends that:

Rec. 15 The telecommunications regulatory body should be empowered to enforce adherence by the telecommunication carriers to prescribed procedures in the establishment of their data communication rates.

(b) Interconnection Issues

Interconnection is frequently taken to refer to the connection of a non-carrier-owned terminal device to a carrier system. The devices are also described as "foreign attachments". There are many other forms of interconnection, however, most of which have an effect on competition. Some of these are:

- Carrier-to-carrier interconnection for competing services — for example, CN/CP Tel terminating dedicated circuits of customers through a local telephone distribution system;
- private system to public system — for example, Pacific Great Eastern railway network interconnecting to B.C. Telephone;
- dedicated private data networks operated by different organizations interconnected through a private computer facility — not permitted at this time by the carriers under the sharing restrictions.

Examples of interconnection which do not involve competition are the following common situations:

- Carrier-to-carrier for non-competitive services — for example, a telephone carrier interconnected to a neighbouring carrier in an interprovincial network;
- "piecing-out" — for example CN/CP Tel may make an agreement with a TCTS member company to extend a communication circuit into a certain area, using facilities of the other party (or *vice versa).*

Co-ordination of Canada's external telecommunications services with those of other nations is the responsibility of COTC[7] which operates computers and other facilities for connection with European and Pacific networks via trans-oceanic cable and satellite. Gateways are located at Montreal and Vancouver.

[7] Department of Communications *Telecommission Study 3(e) An Analysis of International Telecommunications Operations and the Growth and Handling of International Traffic* (Ottawa Information Canada)

This service offers five-bit code only. There is a growing demand within Canada for overseas circuits offering additional code capability and higher speeds, end-to-end.

Connection with the U.S. is directly arranged between the carrier organizations in the two countries. Thus there are interconnections for TWX to TWX, and Telex to Telex or Datatelex services. Most data transfer, however, is via dedicated circuits. The absorption of the TWX facilities in the U.S. by Western Union may result in cross-over of Canadian TWX through the facilities of Western Union, but TCTS connects generally through AT&T and other telephone carriers in the U.S. CN/CP Tel have had long-standing agreements with Western Union, originating with telegraph traffic.

The present state of interconnection between the competing carriers in Canada is here summarized by reference to the trade names of the principal data-oriented services they offer to business firms. The tabulation below lists similar services in the first column; compares them for technical compatibility in the second column; and gives the present interconnection status in the last column. Telex, Broadband and Telenet are offered by CN/CP Tel and others by TCTS. The pairs are grouped according to similarity of service offered to the user.

SIMILAR SERVICE	TECHNICAL COMPATIBILITY	NATIONALLY INTERCONNECTED
Telex — TWX	No	No +
Broadband — Multicom	Yes + +	No
Telenet — MSDS	Yes	No

Legend

\+ But internationally interconnected.
\+ \+ This might require special interfaces and signal translation.

An area of recurring complaints from users is that system interconnection of competitive data services is not being offered by the common carriers, even where the technology is compatible.

In considering some of the probable network developments, attention is drawn to the fact that there are both differences and similarities between the technologies proposed by CN/CP Tel and TCTS. Thus, on toll routes, whereas microwave facilities will probably be similar, TCTS will be in an exclusive position for some time with their LD4 Cable, to service high-density short-haul traffic. Generally, the telegraph carriers' technology will tend to digital systems without voice, whereas the telephone carriers will develop voice-systems with supplementary digital services. In local loops, the present division between baseband and voice will increase as voice modems drop out of digital data networks. Digital repeater amplifiers and multiplexers will appear alongside their analogue counterparts.

Users and all non-carrier organizations involved with development of the new services should make determined efforts to minimize incompatibilities between basic requirements, systems and devices. Some idea of what might come is indicated by D.W. Davies,

"We might give some thought to the possibility of allowing digital communication systems to evolve for a number of years before attempting the synthesis of a unified network. The diversity of users' requirements would then ensure that a large number of incompatible private networks was set up. Even when the requirements of the businesses were plainly similar, as for example, in air-line seat reservations, commercial and other considerations would ensure that there were separate networks."[8]

Previous recommendations have stressed the desirability of interconnection between such networks. The national carriers have not as yet offered jointly integrated switched data communication services. Also, functional incompatibilities between data communications networks, including such items as character codes, error checking and detection techniques and communication protocol, are already apparent, and there is little evidence of major efforts by the computer equipment manufacturers to resolve these differences. Therefore, it is reasonable to assume that interconnections between present and future systems will probably result only from pressures by users and government. To promote such developments, it is recommended that:

Rec. 16 Government, through the Focal Point, should request organizations offering data communication services to effect interconnections between their systems as needed for the development of a coherent data communication network.

If, in the process of establishing interconnections between networks of different carrier, or of non-carrier organizations, agreement cannot be reached, the telecommunications regulatory body should act as arbitrator.

It is therefore recommended that:

Rec. 17 The telecommunications regulatory body should be empowered to conduct hearings and decide on cases involving interconnections between networks of carrier or non-carrier organizations offering data communication services.

Attention is drawn at this point to Recommendation 14, calling for publication of specifications for services offered by the carriers. Specifications will very often be the testing medium for development of interconnection practices. Therefore, requests made in accordance with Recommendations 16 and 17 may affect certain specifications. Additionally, all findings made by the

[8] Davies, D.W., "Communications Networks to Service Rapid-Response Computers", *Information Processing 68 (North Holland Publishing Company, Amsterdam, 1969)*

regulatory body will be in the public interest and should be published. Therefore it is recommended that:

Rec. 18 Decisions of the federal telecommunications regulatory body should be published and made readily available.

By these means it should be possible to advance the data communications systems and services in an orderly manner and with a maximum of open dialogue between government, carriers, non-carriers and users.

3. DIGITAL COMMUNICATIONS

(a) Introduction

The telecommunications networks existing today are systems for the communication of voice, facsimile and video signals which are analogue at their source. Computer data originate in digital form. Conversion from one form to the other is inefficient and costly. Up to the present, data have been transmitted after conversion to analogue form. Digital network systems make use of semi-conductors and reduce equipment requirements, making them economically the most attractive base for future network development. The interrelationships between the analogue and digital systems are principal concerns of carriers, governments and users around the world at this time.

Another characteristic of digital technology is that the signal-to-noise ratio in transmission can be made nearly independent of distance, since the signals can be effectively regenerated at intervals in a manner which has no equivalent in analogue systems. This feature, along with the economies already mentioned, has resulted in a carrier-industry decision to convert transmission systems for voice to digital. This in turn has opened the door for digital transmission of data within the current networks.

The digital world of business machines encompasses a very wide range of bit rates from hundreds to millions of bits per second. International agreement has been reached on standard rates of 600, 2400, 4800, and 9600 bits/sec for transmission of data over voice-networks.

The Pulse Code Modulation (PCM) method is the basic digital method for transmitting voice signals. Associated with this system is a particular bit rate hierarchy. Data streams of different bit rates can be introduced into the PCM transmission network, but only at corresponding levels of the PCM bit rate hierarchy which, in some cases, is a constraint on data transmission.

Another significant feature of digital network development, not as yet determined in degree, is the requirement for circuits that have unequal bit rate capacities in opposite directions. Thus, a slow speed may often suffice for an inquiry to a data bank, but the reply may be lengthy and require high speed for efficiency and to avoid blocking the network.

Switching is crucial to network development. Before the introduction of computers, switching was essentially confined to "circuit switching" between a calling and a called terminal. With this system, the only delays are associated with propagation, and connect and disconnect times.

Generally, there is no processing power or storage capability in a "circuit switched" system. Another technique known as "message-switching" has long been recognized as efficient when low-speed short bursts of information are transmitted over long distances and when relatively long delays can be tolerated. A processor associated with the switch accepts messages from a calling terminal and stores them. It is not necessary for the called terminal to be available at this time. Advantage can be taken of the processor to perform other functions such as multiple-addressing. Use of "message-switching" involves network control of the format of the message. Since the data correspondents at each end of the line are also concerned with format in their processing facilities, "message-switching" will introduce new network signalling and control concepts in which the subscriber has a role for the first time.

Analogue voice signals contain much redundant material which is expensive to store and therefore cannot be message-switched economically. Development of future digital networks will require both classes of switches. It is not known now in what proportion or in what applications they will serve. The immediate trend is for "circuit switching" still to predominate, for digital switching technology offers formidable technical and economic challenges. The financial resources required to meet these challenges are available to few companies in the world.

The subscriber drop or local loop which connects a terminal to the nearest exchange is a facility designed for voice, which consists of pairs of wires, connectors and terminals. Loops without repeaters are limited to a working length of ten miles. A number of circuit developments are needed to make the loops effective for digital data service.

Three characteristics are said to have limited the use of the basic voice technology for data communications. One is that the error rate is not as low as desired; another is that call set-up times are too slow; and the third is that the statistics of voice-transmission require different equipment-provisioning standards from those which would be optimum for data.

While data communications are in the early stages of development, networks require human operators at the terminals. The nature of the data is usually such that errors are detected and corrected by re-transmission. Users consulted by the Task Force did not cite error rates as more than an aspect of inefficiency. To achieve this status for their medium-speed circuits the carriers have found it necessary to functionally separate these circuits from the voice network. As user requirements tend more to end-to-end automation, error rates will have to be improved. This will be done by achieving economic trade-offs between improved error-correction software techniques, controlled by the terminals, and by improved transmission techniques.

Set-up times are important in transaction-oriented data communications. Set-up time in the telephone network is taken up by dialing, waiting for a connection and re-dialing if the call does not go through. Thus set-up time ranges upward to 30 secs, which is a very long data transaction period. If this procedure is carried out for every data burst, the useful transmission time is an inefficient fraction of the total access-time.

Shorter set-up times have been achieved in the Multicom and Broadband services by using special electromechanical switches. This can be considered as only an interim solution. Signalling and control of communications circuits introduce a further delay element which is associated with switching. At present, a terminal can only access a fixed transmission capacity. Special signalling circuits together with some form of time division switching could provide "demand assigned variable transmission capacity" as well as reduced set-up times for data circuits.

The question of equipment-provisioning standards revolves around traffic patterns. There is a well-established ratio for switching capacity, as related to the number of incoming and outgoing voice lines. Long holding times in data transmission may have invalidated this statistic. This may result in voice plant overload in high-density areas. Also services for very short transactions can overload switching processors and there is evidence to show that this has occurred.

In summary, the advances required in signalling and switching are a technical generation away from realization. Unfortunately the time-cycle for new developments in voice plant has been stabilized for a longer period than the data processing industry. This leads to another mis-match, because user terminal technology, and hence requirements in terms of classes of services as well as traffic patterns, appear to the telecommunications industry to be relatively fluid and undeveloped at this time. While great progress is being made through consultative processes, international consensus on basic digital network principles has not yet been reached.

The carriers today have networks which are efficient for analogue signals. New digital technology is being effectively introduced to improve performance. However the teleprocessing of data can be optimized only through development of digital networks designed for the purpose. The universal problem is how best to integrate the two network technologies to provide a general service.

(b) Existing Networks

In Appendix 3 there is a brief review of technical material which was made available to the Task Force by the carriers concerning present and proposed digital technology.

In addition to network activities controlled by the carriers, there are extensive network activities in the private domain. To give an example of such a private network, one corporation has established a message-switched data network

for the purpose of distributing reservations to sporting and theatrical events. The system is capable of being extended to include travel reservations and lottery sales as well, and the latter market is already being exploited in the U.S.A. This is a data bank operation and a single data bank computer is employed for all events for which reservations are filed.

For the system to be economically viable there must be many input-output terminals, widely distributed. This latter characteristic imposes upon the data bank in question the problem of "front-end blocking" — a combined hardware and software problem resulting from the need to terminate several communications lines each of which may contribute only a small amount of traffic. The solution used by the corporation is to use dispersed front ends — a series of small computers which can concentrate local or regional traffic before it is imposed on the data bank. This remote equipment also serves another useful function, that of filing format information. The system is a sophisticated message-switching and processing network, which meets the user-imposed requirements of high utilization of communications lines, efficient administration of file space, and reduction of front-end blocking. It is "in-house", *i.e.*, not accessible to other organizations.

Some computers used in the system are owned by the corporation, others are leased from the manufacturer. The manufacturer also provides all the hardware maintenance. The communications facilities — which are voice-grade private lines — are owned by the carriers and maintained by them. The terminals are owned by the corporation, and because of their number and unique design they represent a substantial portion of the investment. Some of the terminals are maintained, as a special arrangement, by the carrier, while others are maintained by the corporation. Software design, production, and maintenance are all undertaken by the corporation itself.

The Task Force has identified a significant number of such networks as, for example, the airlines' reservations systems. All strive for high utilization of communications facilities in order to reduce communications costs. All are designed to meet the user's own functional requirements and most are not compatible with each other. Comparable networks to serve users outside a single corporate umbrella are not particularly evident in Canada.

The authorization of new "special carriers" in the U.S. by the Federal Communications Commission has attracted much interest and comment among data communications users. Interest is centered on the DATRAN network which will be all digital, and is expected to produce cheaper and more flexible data services than those currently offered by the telephone carriers. This network will cost several hundred million dollars to build and is three to four years away from realization.

The Task Force sees no particular need in Canada at present for a "special carrier" concept for data communications. For example, the present and potential capacities of the long-haul facilities of the Canadian carriers, including those of Telesat and COTC, are more than sufficient to serve Canadian data communications needs. Alternative methods for stimulating the development of data communications in Canada have already been discussed.

(c) Recommendation for Network Development

The plans of the major Canadian carriers are pragmatically related each to their own capabilities and to the Canadian market for data communications. Thus, CN/CP Tel have limited technical resources, and may rely upon world suppliers for the most expensive and complicated network equipment. However, the telephone carriers will, to a large extent, develop their own transmission equipment and probably their own switchers. But, in the latter case and in the supply of terminals, the computer industry will have an important role. It is essential also to recognize that the evolution of user requirements is still in early stages and that these will, to a large extent, control the pace of developments. To the extent that the plans of the Canadian carriers develop autonomously in the quasi-competitive market for data communications, there will be a continuing problem of technical incompatibilities between their networks. The Task Force recommmends that the government should take measures to advance the development of a coherent data communications network in Canada, and therefore should be actively concerned with the plans of the carriers and seek means to minimize incompatibilities.

It is therefore recommended that:

Rec. 19 The plans of the telegraph (railway) companies for the immediate development of their teletype and data services, and the projected plans of the telephone companies for the evolution of a data transmission network should be recognized by government as the present viable direction for the development of data communication facilities, and the government should, through the Focal Point, periodically take cognizance of these common carrier plans, and take steps to ensure the avoidance of disadvantages to users through incompatibilities in the communication services offered and to ensure that the carriers' long-term technical and financial planning is commensurate with the potential and the future requirements for computer/communications in Canada.

Naturally, it must be recognized that technical developments are conditioned by financial considerations; the government should therefore also be concerned with the financial planning of the carriers. For example, in Telecommission Study 2(e), forecasts for 1980 were presented which indicated that total telecommunications revenues at that time will be approximately $4 billion. Capital investment of the telephone carriers will rise from the current $6 billion to $10 billion in 1976, and thereafter to $12-14 billion in 1980. The ratio of capital to annual revenue will therefore be approximately three-to-one.

Assuming a conservative forecast which sets data communications revenues by 1980 at 13-15% of total telecommunication revenues, say $500 million, a cumulative capital outlay related to data communications of $1.5 billion might reasonably be expected.

To date, investments assigned to data communications probably do not exceed $100 million. A public announcement[9] by TCTS in 1971 stated that expenditures of $100 million for a new digital network were planned up until 1976. There is a very large difference between this $200 million and the $1.5 billion suggested above. An explanation for this might be that the simple sums used here do not indicate the portion of voice plant capital which might be assigned to data communications as an indirect cost. Also the figures in the main refer to the largest carrier in TCTS. However, they do serve to illustrate a point. If indeed there is to be a cumulative investment of $1-1.5 billions, or any comparable sum in the period, then the government should require that it be regularly informed of related 5-, 10- and 15-year business plans of the carriers, so as to be assured that such large expenditures could be identified with long-term national policy objectives for data communications.

Recommendation 19 recognizes the free enterprise characteristics of the Canadian telecommunications system. But it does so in anticipation of the evolution of data systems to the point where many major system-users will be demanding network interconnections, maximum technical compatibility and more flexibility in manipulation of the circuits. When this happens, a certain amount of the insularity now enjoyed by the carriers will disappear, for then the issues will become those of competition practices, regulation, rights-of-way and monopoly prerogatives, all of which are in the domain of government.

4. INTERNATIONAL CONSIDERATIONS

World-wide data networks using land-lines, underwater cable and satellites are now commonplace. One large U.S. airline has networks linking six continents with the control facility in New York City, currently handling 100,000 inward messages and 130,000 outward messages per day. This traffic is expected to triple by the mid-seventies. A seat reservation request made anywhere in the world is answered in eight seconds on this system. The U.S. airlines use the international data routes for seat reservations, flight scheduling, maintenance and management. These airlines have their own carrier, ARINC. Canadian airlines have similar facilities.

Data communications services for connection to U.S. points from Canada are much less varied and less flexible than services over solely Canadian routes. Multicom, for example, terminates at the U.S. border. MSDS does cross, but is only economically attractive to users with a large number of stations in Canada coupled with a high traffic volume. At present, users wishing to operate at medium speeds have to resort to private lines. Unlike TCTS, the U.S. carriers permit such private lines to be connected to the switched-network from the U.S. termination point. It is also possible to obtain

[9] Blagg M *op cit*

interconnection to a multi-drop circuit on the U.S. side. The least-cost situation at present is for the Canadian originator to terminate the circuit at a computer centre in the U.S. This centre reaches the desired terminals on its own network. If this network is operating at U.S. bulk rates, the Canadian originator will benefit in cost-savings, as opposed to trying to reach the U.S. terminals directly from the termination of his private line in the U.S.

The Canadian subscriber is restricted to one hypothetical entry port to the U.S. This policy of the telephone carriers prevents subscribers from routing traffic between Canadian points via the U.S.A. Naturally, this single border-crossing philosophy of TCTS is a contentious issue. It may not be fully effective in protecting Canadian long-line revenues because the policy is being circumvented in various ways.

Canadian firms may lease a circuit terminating in a computer centre in the U.S. There, by use of store and forward and concentration techniques, the messages may be forwarded on global nets at rates lower than those available for traffic routed through the Canadian gateways of COTC. There may be more delays or other inconveniences compared to dedicated or public service connection through the Canadian system but there are cost-savings which apparently more than offset the disadvantages.

Since the computer centre has other customers, the system is employing circuits on a shared-use basis, in contrast to the principle of single use of circuits, which has prevailed for voice circuits. Multiple use is internationally considered to be a carrier prerogative. This opinion is shared by the Canadian carriers. Nevertheless, these practices are forcing world recognition that liberalization of leased circuit policies is inevitable. The problems of the non-carrier organizations therefore have also to be considered in relation to international data communications.

The recognized world forum for establishing agreement in principle on telecommunications articles is the International Telecommunication Union (ITU). Its members consist of government representatives. Canada has ratified the ITU convention and is a voting member. Industry participation is through advisory and working committees. Of the latter, the one principally concerned with data communications is the International Telegraph and Telephone Consultative Committee (CCITT). Most of the telecommunication authorities, operating agencies and industrial and scientific organizations in the world contribute to the work of the CCITT. This committee was formed in 1956 as a follow-on from telegraphic studies. In the past, Canadian industry and government have made contributions reflecting their separate interests which were principally technological and administrative respectively. Canada, with a number of other countries, has become aware of the increasing importance of the work of the CCITT. Continued support from the government must be assured as new tasks are undertaken in this field of international relations, for the necessary technical and administrative expertise will take time to develop.

In 1967, the CCITT held its first meeting to specifically discuss the possibility of a separate data network, and in 1968 a Joint Working Party (NRD) was formed to advance the concept. In Canada, an advisory committee for the study of these matters was formed, with members from government (DOC, COTC) and the telecommunications industry.

The following is a specific example of the type of problems to be studied. A major current working party of the CCITT has as its terms of reference (in part):

"To recommend which data services should be offered on a worldwide basis on public networks, and to simplify interconnection."

This is a complicated problem, as many national interests reflect different internal network requirements. Yet if no attempt is made to co-ordinate these requirements, and to make compromises in the best interests of the majority, then the alternative is isolationism through gateways which, in due course, would require intolerably expensive hardware and software.

Satellites are also expected to have an impact on data communications, with regard to both tariffs and technology. The recognized delay problem with satellite circuits does not restrict data transfer to one hop only, as it does voice, but special terminal design and the development of new error-correction techniques in hardware and software are required.

Coincident with the technical developments, new tariff and rate structures must be agreed upon. These will not always be questions of detail. Shared use of private facilities is a case in which tariffs might be used, either to inhibit or to encourage a new international service.

Much must be done then by governments to achieve agreements in principle on features of international switched data networks. In view of the importance to Canada of world data communications, it is recommended that:

Rec. 20 Government, through the Focal Point, should intensify the establishment of a Canadian position on international issues in data communications and ensure appropriate representation on international bodies.

The CCITT only influences governments and industry on matters of general policy for rates and classes of services. There are many serious technological and administrative matters which are decided by direct agreements between the operating carriers. Two technological examples will be cited. The first is the fact that intercontinental speech circuits have echo suppressors. This inhibits full duplex usage for data. It is necessary therefore to reach agreements on the need for new suppressor-design, which would permit control from the customer's terminal (a CCITT recommendation to this effect has already been made). Second, the introduction of digital multiplex equipment resulted in differences in standards between North American and European operators and equipment suppliers which could result in a serious incompatibility in interconnections.

The latter example is selected because it illustrates the manner in which international decisions may affect the Canadian telecommunications manufacturing industry. The Canadian decision on the digital multiplex question may decide whether Canadian manufacturers endeavoring to develop export business will be limited in access to either the U.S. or to the European Common Market.

The situation developing between the Canadian carriers and Western Union, which was mentioned earlier, needs additional emphasis. Western Union is developing a complex message-record data network linking Canada to Mexico and the Central and South American states. Extensive use will be made of computer technology in both hardware and software forms. It will be important to develop a clear forecast of Canadian requirements, and of technological plans from all the Canadian carriers, with regard to use of Western Union facilities. Incompatibilities in network hardware and software, if they are allowed to develop, will be very costly to correct. Unnecessary costs are certain to reflect upon Canadian rates.

The Government of Canada has a responsibility to use its resources to facilitate development of a unified Canadian approach to these and many other problems which are related to agreements made between Canadian and U.S. or other foreign carriers. It is therefore recommended that:

Rec. 21 Agreements between Canadian and foreign telecommunications carriers should be reviewed by the government on a regular basis to ensure that the Canadian position on international aspects of data communications is upheld.

5. NETWORK SPECIFICATIONS AND STANDARDS

In this Report, the word "specification" is used in the sense of a description of classes or kinds of services and facilities that are being offered. Specifications may be forerunners to standards. Commonly they will include reference to specific standards, and in fact a specification could be complete if it called up nothing but certain standards. Specifications may be used in the system sense to define network parameters such as codes, speeds, and signalling conventions. Standards are regularly used with reference to equipment for detailing quality and performance characteristics. Thus, in the case of certification of a terminal, the objective would be to determine that it met certain standards. There are also software and methodology standards.

Liberalization of interconnection policies would accelerate the development of criteria for interconnection of networks or for installing foreign attachments. If the changes are introduced by legislation, the regulatory body would be empowered to administer the legislation. As a result of these factors, however, there will be a requirement for the development of a large and evolving standards base. To date the carriers have controlled system specifications, while the computer industry has developed standards for terminals. The line of demarcation between data processing and data communications is vanishing. This convergence implies an increasing interest

by the data processing industry in the specifications and standards evolved for data communications. Development of these in a fully participatory environment, which includes the computer industry and which is not unduly influenced by any one of the major participants, will be required.

Evolution of specifications and standards comes as a result of a process which starts with policy-setting and eventually reaches a level of engineering design detail as would occur in establishing a hardware standard. The Task Force recognizes that responsibility for the work necessary for the preparation of specifications and standards rests with the suppliers of data communications equipment and services. The major issues of interconnection, however, will require a government presence in policy development in the domestic and international fields for reasons which are apparent in the preceding text. Government involvement is seen to be essential in the process of formulating policies, and ensuring that standards and specifications conform to these policies and meet their intent, and in regulatory decisions concerning the application of standards and specifications in particular cases. To perform all these functions, closest co-operation is required between government computer/communications planning and regulatory bodies, private industry, and institutions directly involved in the standard-setting process. Specific recommendations for such co-operative mechanisms are presented in Part E of this Report.

Chapter X
Data Services Environment

This chapter deals with a number of issues concerned with the provision and use of data services in Canada. The issues arise primarily because of Canada's proximity to the large industrial and technological markets in the United States. Problems associated with the location and information-content of data banks, with the use of data services provided from outside Canada, and with foreign ownership and control are all inter-related and are considered in the perspective of growing requirements in the private and public sectors of Canadian society.

In the discussion on Canadian ownership and control of companies supplying computer/communications goods and services, problems of take overs and other issues which are covered in the recently published report, *Foreign Direct Investment in Canada*,[1] are not considered here. Attention is directed at those issues peculiar to computer/communications, which involve primarily data flow and data banks. Running through all sections of the chapter is a consideration of the problems of control over data flow, of access to data banks, and of potential loss of business in Canada.

1. DATA BANK ISSUES

A data bank may be described as a collection of information which is subject to constant updating with frequent additions, deletions, and changes. It implies also the ability to rapidly access and display a discrete item or items of information on demand and the ability to manipulate and summarize the information in the data bank in a variety of ways. The term "data bank" has arisen only in recent years, concurrent with the use of computers which now perform these functions, in place of the traditional manual methods.

The two main issues regarding government policy for data banks relate to personal privacy and national sovereignty. Personal privacy is the concern of the Task Force on Privacy and Computers, which is conducting a major study on those data banks which contain personal information on Canadians.

The issue of national sovereignty arises in regard to the location of data banks. If they are outside Canada, they are, of course, no longer subject to Canadian laws. This will become increasingly important as measures are introduced to cover such aspects as privacy, security or liability. In addition, use of data banks having cultural or educational content will have an impact on the cultural values of Canadians and on the Canadian identity. These issues are also related to national sovereignty and will be covered in Section 4 of this chapter. Here, attention is focussed primarily on the location of data banks.

A consideration of possible government action in regard to the location of data banks must take into account factors influencing their establishment and use. The costs of establishing and maintaining data banks can be very high.

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1 *Foreign Direct Investment in Canada* (Ottawa, Information Canada (Catalogue No CP32-15/1971), 1972)

They normally require large computers, extensive on-line storage capacity, many terminals, and considerable communications facilities for their operation. Most systems of this nature require back-up central processors and auxiliary storage capacity to guard against the possibility of system failure. In addition, high costs are involved in systems analysis and design, and in the conversion of the base information from written records to storage in the data bank in many instances. Furthermore, to make the greatest possible use of the data bank often implies round-the-clock operations, which usually entail the necessity of maintaining a large staff.

With manual methods, systems and techniques can evolve with time, and numbers of staff can be more easily adjusted in accordance with demand. The absence of this flexibility in computerized systems, together with their high initial and operating costs, mean that the marketing of services must be directed at the broadest possible areas of demand.

It is not surprising therefore that there are a number of data banks in existence which cater to a North American, or even world market. In a number of cases a continental market is in fact a more logical entity, as for example in the in-house data bank operations of certain credit card organizations, such as Diners Club or American Express, which contain the files on a mobile population. These two organizations hold records in the U.S. on a very large number of individuals from many countries, including nearly a quarter of a million Canadians.

Similarly, the Medical Information Bureau, which is an unincorporated association of Canadian and U.S. insurance companies, serves a North American market, and maintains records on Canadian and U.S. nationals. Canadian insurance companies have pointed out the benefits which accrue from this data bank to their own operations, and have suggested that any limitations imposed on the storage of this type of data outside Canada could have serious repercussions on the international insurance business. The Canadian insurance companies operate internationally, and maintain records in Canada on foreign as well as Canadian residents.

These examples are given here to emphasize the fact that a data bank, even one containing information on Canadian customers, should not necessarily be regarded as logically requiring location in Canada.

Another kind of data bank which raises issues of national sovereignty is the type which relates to Canada's natural resources. Many data banks, such as those in the Department of the Environment on water resources, are operated and controlled by government departments. If such data banks come to be handled by data service organizations in the private sector, the government will need to be assured of sufficient security and protection measures.

There are, in addition, instances where data banks on natural resources are maintained in-house by exploration companies, some of which have headquarters in the United States. In general, any in-house data bank which is used solely by personnel in that organization for internal decisions and

operations should not normally be of concern to government. In this particular instance, however, where information relates to Canada's natural resources, government has a legitimate interest.

The Task Force was unable to find evidence that any important Canadian resource information is kept solely outside the country. For example, reports are received by the Canadian Government on exploration activities in areas under federal jurisdiction. Practices in areas under provincial jurisdiction differ, but, in the main, geological and other resource information is either provided to provincial authorities or is retained in Canada by the companies themselves.

These issues by no means arise in regard to all data banks. There is a growing legitimate requirement of many organizations for the establishment of, and access to, data banks, for example, for environmental and market data which can be used to evaluate proposed policies, strategies and management decisions, and to seek opportunities for new endeavours. In these cases, collating of information from many sources inside and outside the country is necessary.

Therefore, there are a number of considerations which lead logically to a need for data banks serving users in more than one country. However, the issue of loss of control over data banks outside Canada does pose important questions. As measures become necessary in certain areas — with regard to privacy, security, liability or ethical standards for data bank operations — it will be important to retain particular data banks in Canada. Possible steps to achieve this will be discussed at the end of the following section.

2. NORTH-SOUTH DATA FLOW

Considerable concern has been expressed to the Task Force about the attraction of U.S.-based data processing and data communication services, particularly in the light of recent U.S. policy announcements. While it appears that at present this effect has not yet led to a large flow of data across the border, the potential exists, and a trend is evident towards increasing use of facilities located south of the border. The inherent economies for U.S.-based corporations with operations in Canada, and the probability of reductions in data communication rates through offerings such as those of the Datran Corporation, are only two facets of this complex problem.

Before considering options for possible government action, a more detailed examination of some of the issues is necessary.

(a) Task Force Findings

Much of the data flowing to the south is generated by in-house operations of Canadian subsidiaries of U.S.-based companies and is directly concerned with the parent-subsidiary relationship. The economies and advantages of centralized data processing facilities are considered by these companies to be important to such operations, and constraints on the location of data processing capability, which attempt to keep the work in Canada, are claimed

to result in higher operating costs to all divisions of a company including those in Canada. A submission to the Task Force, typical of the concern of such organizations, stated that,

"Historically it is the right of all companies to exchange information within their own organizations whether the information is in one, two or several countries. We believe that if Canada is going to continue to participate effectively in international business, it will have to allow communications in all directions and not hamper the North-South flow of information in order to encourage communications between the Eastern and Western parts of Canada."

For economy and other reasons, subsidiary companies draw on the resources of the parent organization for managerial and technical skills and for financial support. For the same reasons, it may be expected that, in many situations, subsidiaries will tend to use the data processing services of the parent corporation to enhance their own cost-effectiveness.

It should be pointed out, however, that not all Canadian subsidiaries of U.S.-based corporations use the data processing facilities of the parent for all their requirements, and that, in fact, a great deal of data processing is performed in Canada on their own facilities. It should be further pointed out that there are also Canadian-based companies with subsidiaries in the United States where the reverse situation obtains. This presents a similar situation, but in the reverse direction, with some of the work of the subsidiaries in the United States being done in the Canadian headquarters.

Part of the north-south flow of data traffic arises from user-needs to access specialized data banks, programmes or other services, which are not readily available in Canada. An example is the analysis of seismic exploration data. It was suggested to the Task Force that a large volume of seismic data processing is being done in the U.S. by multi-national companies. To assess the dimensions of the problem, the Task Force commissioned a study by a consultant, who obtained data from 35 of the companies initiating seismic work. Of the 35 companies, 21 use terminals for access to external computers, either in Canada or the U.S. However, they also have 51 computers installed in Canada used for pre- and post-processing of analyzed seismic data, for administrative work and for local geophysical, geological and engineering analyses. Those companies using U.S. computers for seismic analysis in oil exploration do so not only because of the highly specialized requirements, but also because of the high degree of internal corporate security which must be maintained.

The study estimated that the total 1971 expenditures of companies in the Calgary area, including the 35 companies surveyed, for seismic data processing in the United States was approximately $5 million. This represents about 12% of all data processing expenditures by those companies, including the costs of services provided by Canadian data processing service bureaux. Other estimates place this figure somewhat higher.

This particular example, while here related to the need for special services, is also concerned with internal policies and operating practices of particular organizations in the private sector. Another example of the use of U.S.-based specialized data processing services by Canadian-based organizations (though not through telecommunication lines but through mailing of forms and reports), is in the field of medical audit services (University of Michigan PAS/MAP services). The extent of the use of these services by Canadian hospitals, and the implications involved, are discussed in Volume II, Part B3.

In a Task Force survey of Canadian-based user organizations, it was found that of 60 companies which are major users of data communications, only 22 have border-crossing links. By comparison with the total number of computer/communications users, it appears that only a small number connect with the United States. Of these, some use more south-to-north data transmission than north-to-south.

Also, a number of Canadian-based data processing organizations market their services in the United States. Of 20 Canadian-based service bureaux offering teleprocessing services, 9 have clients in the United States. Revenues derived from their U.S. business in 1970-71 represented around 10% of their total revenues from all services, or between $1 and $2 million.

The available information did not allow a quantitative analysis of the flow of data for processing purposes from north to south compared with that from south to north. However, statements made to the Task Force by Canadian service bureaux and computer centre operators indicate that their prime concern is on the issue of Canadian subsidiaries of U.S.-based corporations transferring their data processing activities to their headquarters, thereby causing a potential or actual loss of business to the Canadian industry. In comparison, the issue of Canadian user organizations utilizing U.S.-based commercial data processing services is considered a lesser problem, which is also compensated by an increasing flow of business in the opposite direction. However, mounting dissatisfaction on the part of Canadian users, possible changes in policies of U.S. parent companies, and further technological developments in the United States all help to emphasize the growing problem for the future of data processing in Canada.

The recent decision of one Canadian service bureau organization[2] to locate a second computer in the offices of its U.S. affiliate because "connecting Vancouver into Washington is considerably cheaper than connecting Vancouver into Toronto" is indicative of a trend which is likely to increase unless strong measures are taken to improve service availability and rates in Canada.

(b) Policy Approach

In assessing possible government policies and future courses of action, it is necessary to take account of the practical difficulties inherent in attempting to

[2] Sharp I.P. Associates Limited. The Newsletter. *Canadian Datasystems*, April 1972, Vol.4, No.4, p.17.

restrict or limit the flow of data across international boundaries. Traditional methods of international control of commodity transfers include customs tariffs or taxation measures, quota provisions, export licences, and anti-dumping controls. Unfortunately, although data are treated increasingly as an economic commodity in many areas of business activity, they are also a commodity that is almost impossible to value systematically.

The problem of valuation is compounded by the fact that the value to be determined in this context is not the commercial worth of the data themselves, but rather the commercial value of the computer processing which has transformed data from one form into another. Measuring this at the point of border transfer creates problems, since it is largely independent of either the volume of data or the technical form in which they are transferred (tapes, discs or through telecommunications lines).

The Task Force has concluded that, rather than attempting to impose restrictions on the cross-border data flow itself, the effectiveness of which would be doubtful, a better solution would consist of positive measures to strengthen the availability and the cost-effectiveness of Canadian computer/communications services. The Task Force considers that competition within Canada is the moving force which will in the long run provide the needed variety and quality of computer/communications services at lowest cost to the user. Likewise internationally, the Canadian competitive position must be encouraged if Canada is to survive in the North American information-flow market. The Task Force contends that inhibition of information flow between the U.S. and Canada would be, on balance, economically, technically and socially detrimental to Canada and that the Canadian computer/communications industry must therefore compete with cross-border flow of U.S. information services.

How then can Canada develop a self-sufficient computer/communications service industry and at the same time participate freely in the North American information-flow market?

The Task Force recommends the stimulation of the Canadian computer/communications service industry within a competitive environment as the method with most potential for achieving this objective. As outlined in greater detail throughout this Report, particularly in Chapter 11, the positive stimulative approach proposed by the Task Force includes:

- Establishing and maintaining a competitive computer/communications service industry within Canada;
- government financial and technical assistance in research and industrial development for the supply sector of these services;
- government co-ordination in the gradual evolution of a coherent data communications network;
- government participation in the development of national and international standards;
- government purchasing of computer/communications products and services from Canadian industry;
- government support for the development of computer/communications networks of broad social benefit;
- government financial assistance on a case-by-case basis in the form of subsidies to users or suppliers to meet specific service needs of social importance;

- moral suasion by governments directed towards encouraging Canadian subsidiaries of foreign firms to employ Canadian computer/communications services wherever possible;
- review of customs tariffs for the import of equipment and components not available from Canadian manufacture;
- government support of professional and industry associations in the provision of training programmes in collaboration with educational institutions.

Government, through the Focal Point, would have the critical task of continuous study and evaluation of the situation. If the implementation of the recommended positive actions has had insufficient time to be effective and a trend to increasing losses to Canadian data processing activities gains momentum, certain measures for protection and sheltering of the industry might be considered. Such protection or sheltering could be of a general fiscal nature or applied in a more specific mode. The general method is apparent in proposals such as disallowance for business expense purposes of certain expenditures by companies operating in Canada on computer/communications services supplied by firms outside Canada. The identification of such expenditures, without unduly restricting services which are not available from Canadian sources, would create extra administrative problems and costs to users and government. More specifically, customs tariffs can be applied to data processing information coming into Canada in the form of computer print-outs, magnetic tapes, discs, punched cards or punched tape as administered at present by the Department of National Revenue. The main problem lies in the fact that the information can alternatively be transmitted via telecommunication means across the borders without such tariff. The application of traditional tariff principles to such electronic transmission of information would have important administrative, technical and legal implications.

The Task Force considers that these methods would eventually lead to higher costs and a smaller variety of products and services available in Canada. Also, reciprocal action by foreign governments, such as the United States, would restrict Canadians from participating in foreign markets, including the side-effect of restricted freedom of information-flow, inherent in such action and counter-action.

The Task Force has concluded that positive competitive and stimulative measures should be the primary approach for advancing the development of Canadian computer/communications services.

The Task Force therefore recommends that:

Rec. 22 Policies in computer/communications development should be oriented, in consultation and co-operation with the provinces, towards improving service availability and reducing costs in Canada in order to offset economic and technical incentives for meeting user needs through facilities outside Canada.

Positive measures to improve the availability of data services in Canada, and to improve the Canadian development of computer/communications facilities, are those to which this whole Report is addressed. The Task Force therefore considers that the early implementation of its recommendations is the most effective safeguard against problems resulting from the availability of data services outside Canada.

3. REGISTRATION FOR DATA SERVICES

Data Services are here taken to include data processing services and data bank services offered through telecommunication links.

It has been emphasized, earlier in this report, that the Task Force recommendations are based on the fundamental concept that a suitable level of competition is the necessary stimulus for innovation and development. It has also been pointed out that there are dangers in a complete *''laissez-faire''* attitude by government, and that government intervention may be necessary in certain situations, such as those:

- Where particular participants may take undue advantage of their other business activities, leading to unfair competitive practices;
- which may lead to socially undesirable results;
- which could increase Canada's vulnerability to undesirable influences exerted by rapid technological and market development in foreign countries.

The Task Force also takes the view, however, that in order to obtain the necessary balance, it is essential that the government should obtain information which will permit it to observe the effects of competition and monitor trends and developments, so that judgments and decisions regarding government action can be based on factual information. This will be particularly important as the changes caused by new entrants into the data processing business (as recommended in Chapter VIII), and by the liberalization of present practices regarding foreign attachments, interconnection, re-sale and sharing (as recommended in Chapter IX), affect the market-place.

As the types of data processing services extend into social and cultural areas, and as the impact of computer/communications systems becomes more pronounced in their effect on the individual and on society in general, the government may need to take a more active role in order to protect the public interest. Again it is necessary to have a firm foundation of factual information on which to base any decisions for action.

The Task Force has had difficulty in assembling information on the data services industry. No one government source was able to provide information on companies offering data processing services. In order to arrive at an assessment of the size and scope of the industry and its components, it was necessary to examine and summarize data from a number of sources. The information obtained was in many cases difficult to collate, for different sources often used dissimilar definitions of measurements, and in some areas

information was incomplete, or did not relate to the specific requirement, and approximations had to be used.

The issues raised in the previous sections of this chapter on data banks and north-south data flow demonstrate the need for more readily-available and consistent information on the data services being offered commercially in Canada.

Accordingly, the Task Force recommends that:

Rec. 23 Organizations offering data services commercially to customers through telecommunications facilities, with terminals on remote premises, should be required to register with an appropriate body, and file information on their corporate structure, and on their data services.

Further details on the proposed registration process and the "appropriate body" are contained in Part E of this report.

This recommendation does NOT call for the establishment of a discretionary licensing system, which would only permit certain organizations to offer data services. On the contrary, it is a system open to all organizations, and merely requires the provision of information on the corporate structure of the organization itself, and on the data services offered.

This information will not only assist the government in formulating policies, but will also, by the publication of appropriate non-confidential items, be of direct assistance to commercial and other users by providing fuller information on the nature of available data services.

There will also be a number of indirect benefits to users. Consolidated information on available data services will help to identify areas where an uncontrolled proliferation of types, performance characteristics and techniques of data services might lead to incompatibilities which would be disadvantageous to users, but could be remedied by introducing suitable standards and standard practices.

In addition, the information could help to protect user interests by facilitating an assessment of the needs for introducing measures relating to such matters as ethical standards, security protection, privacy of sensitive information, and liability.

4 MAINTAINING A CANADIAN PRESENCE

(a) Issues

The preceding sections on data banks and north-south data flow have shown that there is no easy way to control the flow of data at border-crossing points, nor can a need for such control be clearly identified at this time. Therefore, it appears that any restriction on the transfer of data between

Canada and the United States, which may be found desirable for one reason or another, can be effectively carried out only when applied to the respective sources or recipients in such transfers. Three questions then arise:

- What are the motivating forces for the transfers?
- What are the criteria that make restrictions or limitations on the transfer desirable?
- What measures can be applied to control the transfers?

Motivating Forces

The first question is answered essentially by the discussions in the preceding two sections. The main forces were identified as:

- The economics of data processing and data communications on either side of the border;
- corporate policy of foreign corporations operating in Canada;
- availability of special computational expertise, or special sources of information (data banks) in either country.

Criteria for Restrictions

The second question regarding the desirability of restrictions requires a brief discussion of economic, legal and cultural issues.

When data processing for business purposes in Canada is done through remote connections to computers located in the United States, this represents a direct or a potential loss of business to Canadian data processing enterprises. The effect of such loss of business is to reduce employment opportunities, preventing a wider development of expertise in Canada and inhibiting the build-up of the business volume to a level where economies of scale would result in lower costs. The last point directly reinforces the economic motivation which may have led to the transfer of activities in the first place. In the economic interest of Canada, it would be desirable to retain as much of the Canadian data processing business as possible in the hands of Canadian-based organizations.

Another point of economic impact has to do with the adequacy of program packages developed in one country and applied in the other. As the nature of computer application programmes relates directly to the type and nature of the business in which these programmes are used, it is not unlikely that a readily-available foreign package, used in Canada is, in fact, not well suited to Canadian requirements and results in unsatisfactory operations. This argument leads to the conclusion that "Canadian problems should find Canadian solutions", and that it is therefore desirable to maintain in Canada all the expertise and skill required for developing these solutions for software as well as for application-oriented and communications hardware.

The legal implications of data transfer across national borders can be touched on only briefly. The aspects of personal privacy, copyright, liability, bonding, and software protection are examined in Volume II. The main point to be

made here is the placing of emphasis on the many areas of a legal nature which might be considered by a Canadian user in deciding whether to use commercial data bank and data processing services from:

- A foreign supplier located outside Canada directly through trans-border lines or through the lines of a representative organization in Canada; or,
- a Canadian subsidiary of a foreign supplier, subject to foreign control; or,
- a Canadian-controlled organization.

Protection with regard to privacy, liability, confidentiality, continuity of service, as well as against fraud or breach of contract, may well be substantially different for the different categories of suppliers.

Data processing and data bank services are instruments for information transfer. As they are used for information retrieval and dissemination, for educational processes and for entertainment, they convey cultural values and will increasingly form part of the cultural life of the country. As these services find wider distribution, eventually through communication lines into the schools and homes of the nation, they will assume the characterisitics of present-day broadcasting and CATV services, for which the need for Canadian control and adequate Canadian content is accepted. This aspect of the potential role of computer/communications in the distribution of information with cultural content to the general public must therefore be reflected in corresponding requirements to ensure that the user has sufficient choice of material including a sufficient volume from Canadian sources.

Measures for Control

There remains the third question on the nature of possible measures for restrictions or limitations, on international transfers.

Since the cost of Canadian computer/communications services is a frequently cited reason for increasing use of services supplied from the U.S., the most effective way of reducing the incentives for the ''north-south flow'' consists of measures to reduce Canadian costs of computer/communications and to increase the strength of the Canadian-based commercial service industry. This approach was discussed in the preceding section, ''North-South Data Flow''.

In the case of foreign-controlled corporations with subsidiaries in Canada, governments may find it advantageous to urge that these companies use, to the greatest possible extent, Canadian-based data processing facilities to serve the needs of their Canadian operations, particularly where suitable Canadian services already exist.

Governments may also find it advantageous to actively support the establishment of specialized service centres and data banks for handling special programmes of general importance to business and industry in an area. Also, selective subsidies might be considered on a case-by-case basis to help users or suppliers to overcome specific problems. This may apply to the price

of services as well as to other costs (such as those for programme conversion) which may occur in connection with the substitution of U.S.-provided services by Canadian services.

The attractiveness of Canadian commercial data processing and data bank services would, in many cases, be enhanced by the existence of a satisfactory legal framework for the protection of customers in questions of privacy, confidentiality, and liability, and in appropriate standard practices with regard to continuity of service, bonding, and emergency services.

For services supplied to public institutions and governments, Canadian control of the data processing organization in all financial, technical and operational aspects is likely to be a prerequisite, except in unique cases where services from foreign suppliers provide a better alternative with regard to specialization or other specific characteristics not involving legal risks.

When computer/communications services distribute information with cultural content to the public at large, legislation will likely be required to hold the distributing organizations to specified limitations on foreign participation and foreign content. In this connection, the federal and provincial governments may also find it necessary to stimulate the volume of specifically Canadian cultural and educational material that can be made available through computer/communications. Not all remote-access computer services, even if extended to the homes of private individuals, fall into this category. Therefore, difficulties arise in the definition of a dividing line between strictly private subscription services for information of a general nature, such as scientific or technical data, stock quotations, or travel information; and services which affect cultural values in such fields as education, entertainment or politics. A means for providing information to identify and segregate the various categories of computer services is the registration process recommended in the preceding Section 3.

(b) Present Situation with Regard to Canadian Ownership & Control

Earlier sections of this chapter have raised a number of problems associated with the use of data processing and data bank services provided by foreign organizations. Before presenting a policy approach for dealing with this situation, consideration is given to the present degree of Canadian ownership and control in the supply segment of the industry.

The situation is complicated by the fact that three official Canadian sources of information on foreign ownership use different methods and measurements. Statistics Canada uses consolidated figures for a group of companies under common ownership, and takes into account long-standing debt as well as voting shares. The Department of Industry, Trade and Commerce publishes information obtained in a survey of foreign-controlled companies with assets of more than $5 million. Completion of the survey questionnaire is voluntary.

Information is also collected under the Corporations and Labour Unions Returns Act (CALURA) which includes corporations having at least $250,000

in assets, or $500,000 in annual sales. CALURA differentiates between foreign ownership and foreign control.

The 1969 Annual CALURA report states that,

> "A company is considered to be foreign controlled if 50 per cent or more of its voting rights are known to be held outside Canada and/or by one or more Canadian companies which are, in turn, foreign controlled. Geographically, control of a Canadian company is ascribed to the foreign country where the majority of the company's voting rights are actually held or where the majority of the voting rights of its Canadian parent company are held. The whole of the corporation (whether measured in such terms as total assets, sales, profits or equity) is assigned to one or other country of control."[3]

With regard to ownership, the Report states that,

> "Under the concept of ownership used in this report each corporation is classified according to the percentage of its voting rights which are owned by non-residents either directly or through other Canadian corporations and the whole of the corporation is assigned to this particular degree of foreign ownership."[4]

Under these definitions of foreign ownership and foreign control it is possible that,

> "...foreign control of a corporation may exist despite the fact that foreigners own less than 50 per cent of its voting rights [and that a company may be] foreign controlled even though it is only 40 per cent foreign owned."[5]

Faced with these difficulties, and not having the powers of a Royal Commission to obtain private corporate information, the Task Force was not able to obtain adequate information on revenues and other financial items, categorized according to the degree of Canadian ownership.

The latest information collected under CALURA, and made available in summary form to the Task Force, relates to 1969. At that time, 176 of the 486 companies now identified (Table 1, Chapter IV) as part of the present computer/communications supply industry were of sufficient size to be recorded in the CALURA files. Table 3 summarizes that information for 163 of these corporations, broken down into three segments of the supply industry described in Chapter IV. The information from CALURA does not give

[3] *Annual Report of the Minister of Industry, Trade and Commerce under the Corporations and Labour Unions Returns Act (Part I, Corporation) 1969* (Ottawa: Department of Industry, Trade and Commerce, February, 1972), p.73

[4] [illegible] 4

[5] [illegible]

Table 3

The Ownership of the Canadian Computer Industries for the Year 1969(1)

	Service Suppliers			Hardware Suppliers			Other Product Suppliers		
	Canadian (2)	Foreign (3)	Total	Canadian	Foreign	Total	Canadian	Foreign	Total
Number of Corporations	26	14	40	34	69	103	11	9	20
% Total	65	35	100	33	67	100	55	45	100
Assets ($,000)	60,868	29,210	90,078	444,692	1,551,385	1,996,077	40,305	98,455	138,760
% Total	68	32	100	22	78	100	29	71	100
Sales ($,000)	17,346	34,799	52,145	539,871	1,828,024	2,367,895	67,387	124,023	191,410
% Total	33	67	100	23	77	100	35	65	100
Profits ($,000)	(2,474)	1,667	(807)	17,437	182,099	199,536	10,033	19,301	29,334
% Total	—	—	—	9	91	100	34	66	100
Profit Sales %	—	5	—	3	10	8	15	16	15
Equity ($,000)	32,144	17,226	49,370	233,412	769,915	1,003,327	28,545	52,710	81,255
% Total	65	35	100	23	77	100	35	65	100

Notes:

(1) Source: Corporations and Labour Unions Returns Act (CALURA), Statistics Canada

(2) Canadian Ownership indicates that over 50% of the voting rights of a corporation are owned by Canadians

(3) Foreign Ownership indicates that over 50% of the voting rights of a corporation are owned by non-residents

a breakdown for the 13 corporations in the communications segment. These segments of the supply industry may be summarized as follows:

- *Hardware*, encompassing manufacture or supply of computers, peripheral and terminal equipment and computer-related communications equipment.
- *Services*, which include those provided by the computer services bureaux, software houses, consultants, facilities management firms, data preparation firms, and private organizations engaged in computer education and training, and personnel placement.
- *Data communications*, encompassing the provision of facilities and services for the transmission of data between computers, and between computers and terminals.
- *Other products*, which includes the provision of operating supplies and consumables, as well as computer environment equipment, such as air-conditioning, false flooring, and fire-proof storage.

Revenues are quoted for *total* sales, and do not relate only to computer/communications products and services. In addition, the revenues of computer manufacturers from their service bureau operations are included under revenues in the hardware supply segment.

In the services supply segment, the number of Canadian companies and their assets represent approximately 2/3 of the totals for the segment, but their sales account for only 1/4 of the total revenues for the segment; in aggregate they showed a loss, whereas foreign-owned firms showed a profit. In the hardware supply segment, profits of Canadian-owned firms represented only 3% of sales, whereas profits of foreign-owned firms represented about 10% of sales. In the other two segments, the profitability of Canadian-owned firms compares favourably with that of foreign-owned firms.

In the service segment, the majority of the independent service bureaux remain Canadian-owned and controlled. The Task Force estimates that, of the $133 million total revenue for 1970-71 for this segment (see Table 1, Chapter IV), some $114 million is attributable to sales of service bureaux, and that about one-third to one-half ($35 to $55 million) are revenues from the service-bureau operations of foreign-owned computer suppliers.

(c) Policy Approach

The four segments of the industry require separate consideration.

The "other products" segment, for example, covers such items as paper forms, air-conditioning, false floors and other "support" products, which do not have the particular characteristics associated with computer/communications. This segment raises none of the problems peculiar to computer/communications, and therefore does not require special treatment in regard to foreign ownership.

The communications segment, on the other hand, differs markedly from most other industries in Canada by virtue of the fact that it is regulated. The

complexities of the regulatory procedures are reviewed in Volume II. An indication is given there of the powers of the different regulatory bodies in regard to mergers, issue of shares and debentures, and other items touching on the ability of foreign interests to increase their ownership of, or control over, telecommunications in Canada. The majority of the carriers are already under Canadian ownership and control, and possible future government policies must be developed in the context of the overall telecommunications field.

The hardware and services segments of the industry require particular attention, for they raise a number of special issues which must be carefully considered in the formulation of a policy on foreign ownership and control.

Hardware Supply

Some other countries have considered it of national importance to support the development of an indigenous computer main-frame manufacturing industry in order to reduce their dependence on United States technology. Large amounts of capital have been provided for this purpose from public funds. The limited size of the Canadian market, the protectionist measures taken by other countries, the large capital investment required, and the dominant position of U.S.-based companies are all factors which will deter the entry of purely Canadian enterprises into the field.

The suggestion is made, from time to time, that Canadian strategy should be to undertake joint ventures with European or other countries. This, it is alleged, would serve the dual purpose of lessening Canadian dependence on U.S. technology and of providing an entry to foreign markets. Notwithstanding the merits of such a plan, the realities of the situation must be recognized.

First, there does not appear to be any particular advantage for a European or other non-U.S. computer main-frame manufacturer to consider such a venture. The available markets could not be guaranteed, and a single production facility would probably be sufficient for total requirements. The Canadian company would probably be the junior partner, manufacturing components for assembly in the other country.

Second, differing standards in Europe and North America are obstacles not easily overcome. Canada is firmly committed to North American standards and practices and, until international agreements are reached, changes to equipment to suit different conditions in foreign countries will still be required.

Third, the history of international joint ventures on a government-to-government basis in areas of high technology has been plagued with difficulties. Escalating costs, production delays, and insufficient market research are but a few of the problems often encountered.

This is not to suggest however, that Canadian-owned companies should ignore the possibilities of joint ventures with non-U.S., foreign-owned

companies, but rather that this should be arranged at a company-to-company level; government involvement should be limited to initial support of the project only when it shows demonstrable chances of success.

It must also be emphasized that Canada has received, and continues to receive, large benefits from U.S. technology in the field of computer/communications — benefits which make it possible to serve the domestic market as well as providing opportunities for export to the United States.

In addition to special measures which may be used to support industry in Canada, leverage may be exercised through the procurement practices of public institutions, which are considered in Chapter XI.

Supply of Services

The services segment of the industry requires particular attention, especially in regard to software development, and the provision of data processing services.

Software development and supply, from the viewpoint of Canadian ownership and control, is conceptually very similar to hardware development and supply, and may therefore be treated in a similar fashion. Machine-oriented software may, in fact, be regarded as an integral part of the hardware system. The objectives of government policy should therefore be to encourage firms to establish the necessary R & D facilities in Canada, so that Canadian expertise can be developed and maintained.

Applications software, *i.e.*, problem-oriented programmes developed to meet specific user-needs, are of particular significance in the context of Canadian ownership and control, because a small creative group of technologists, without large initial capital investment, can be effective in software development and systems-design.

In addition, as systems-design and applications software are the means of solving specific problems, it is essential for Canada to have the necessary expertise to develop Canadian solutions for Canadian problems.

It is only recently that the Department of Industry, Trade and Commerce has considered direct financial support to the development of software through its industry support programmes. The problems posed by software support are briefly outlined in Chapter XI.

In addition, every advantage should be taken of the stimulation that can result from government procurement policies, which are discussed in greater length in Chapter XI.

Data processing services, which are here taken to include data bank services, are unlike many other services in that they can be provided on a day-to-day basis from a remote location. A further significant distinguishing feature is that they are concerned with *information content*, much of which is critical to the operations of government or private industry, or is "sensitive" in other ways, as for example, in containing confidential information on Canadian individuals.

These two distinguishing features make the data processing services industry one which merits close attention by government in regard to foreign ownership and control. Of particular concern here are the economic and legal issues outlined earlier in this chapter, with special emphasis on the fact that users in many instances will need to be assured that data submitted for processing and analysis remain subject to Canadian laws and that management and operational decisions are not directed from outside the country.

Present users of data processing services can decide for themselves when it is in their own interests to use Canadian-controlled organizations for their requirements. However, it is essential that the government should support the development of a strong Canadian controlled data processing services industry so that, as services are extended to smaller businesses, the professions, and the general public, there are Canadian organizations able to provide them.

Accordingly, the Task Force recommends that:

Rec. 24 **Governments should recognize the importance to the public interest, of a strong Canadian-controlled data processing services industry.**

Programmes similar to PAIT could be used to support software development for new types of services, but cannot easily be used in support of the regular data processing services themselves, for the emphasis in these programmes is on innovation. Other incentive programmes for Canadian-controlled organizations to offer data processing services also raise practical difficulties. The Task Force has therefore concluded that the government can best support the development of a Canadian-controlled data processing industry through its procurement policies.

In obtaining such services from the private sector, the main criterion in procurement must continue to be that they meet requirements of effectiveness, efficiency and cost. But, within these constraints, preference should be given to Canadian-controlled organizations. In particularly sensitive areas, associated, for example, with personal information or resource information on government files, the government should insist that data not be transmitted outside the country.

Canadian-controlled organizations are already well represented in the data processing services industry and, in fact, form the majority of corporations engaged in this activity. The government should capitalize on this and not allow the advantage to be lost. By orienting the spending of public funds towards these organizations, a more stable Canadian-controlled computer services business will develop. The increased use by government of services from the private sector will help to provide the much-needed base work-load.

Cultural Aspects

As data processing services extend into a cultural context, and as they move into the home, their content will become enmeshed with the social values

and way of life of Canada, and will thus have an impact on Canadian identity. In this context "home" is not used to denote the four walls and roof of a physical dwelling but rather the concept of an individual's environment; data services into the home could influence an individual just as his choice of radio programme to some extent reflects or has an effect on his personality.

If steps are not taken to strengthen the Canadian-controlled data processing services industry as outlined in the previous section, there will be a growing dependence on services developed elsewhere and offered through communications links to users in Canada. Not only may these not meet Canadian needs — for industry and for social systems — but, in addition, as cultural content increases, they will have an increasing effect on individuals.

At present, services to homes are virtually non-existent and therefore pose no problem. But governments should be aware of the potential development. This, in addition to the arguments already advanced, places greater importance on government support of a strong Canadian-controlled data processing service industry.

As services become personally available to Canadian citizens, they become similar in many respects to the services provided by CATV operators or broadcasters, which are regarded as amenable to direct restrictions on foreign ownership, and to standards for Canadian programme content. It is conceivable, therefore, that requirements may be developed which in certain respects parallel those applied in broadcasting.

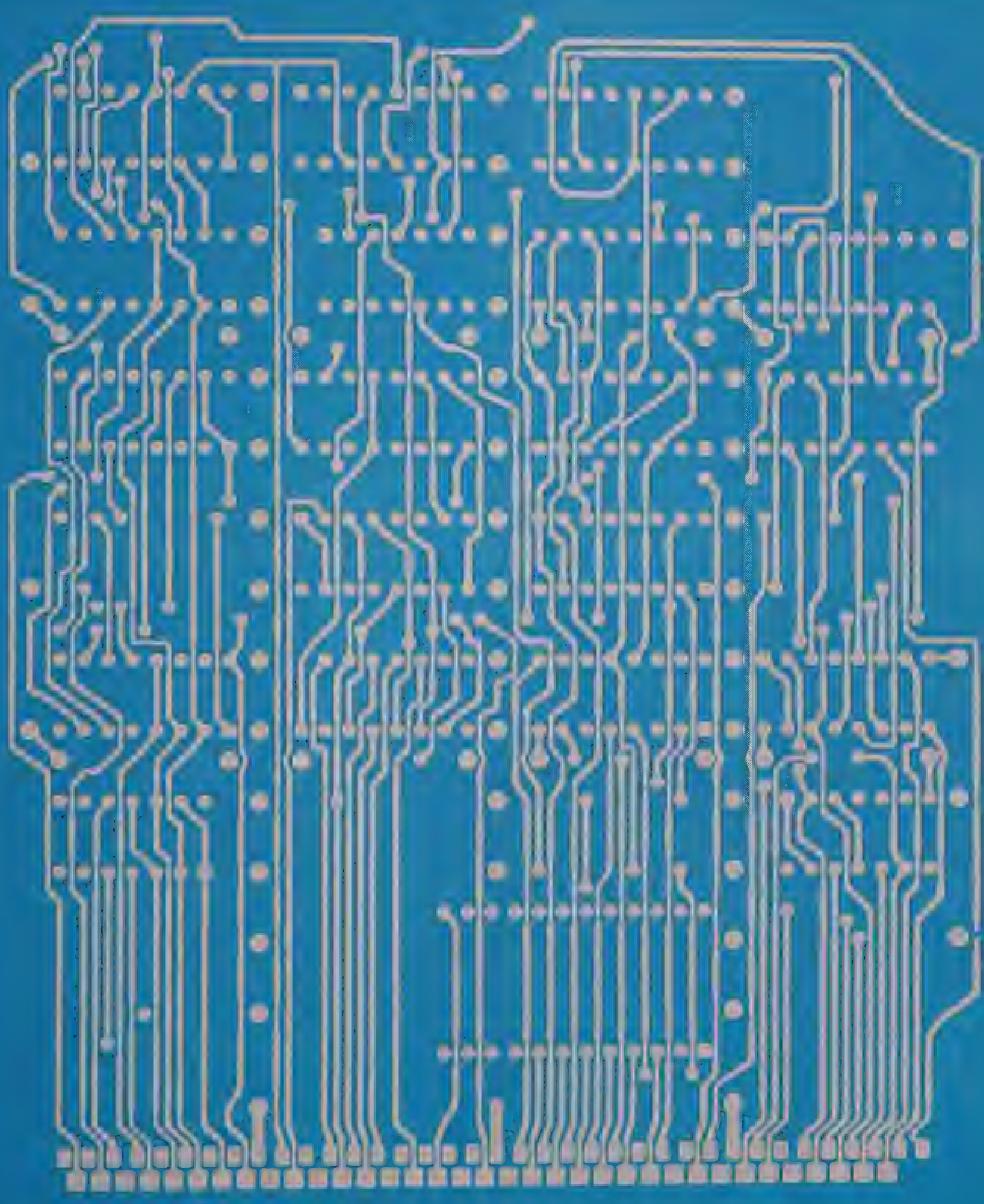
Accordingly, the Task Force recommends that:

Rec. 25 Before computer-based information services are offered on a regular basis to individual Canadians and the public in general, governments should consider the feasibility of imposing special requirements on Canadian ownership and control of organizations providing services which convey cultural values analogous to those conveyed by broadcasting systems, and on the volume of material from Canadian sources made available through such services.

Part

1

Stimulation of Development



Chapter XI
Government Actions Related to Stimulation of Development

1. IDENTIFICATION OF PRIORITIES

(a) Identification of User-Needs

User-needs may be broadly described as reflections of basic demands and of problems which arise when users undertake the development or use of computer/communications systems. Frequently, these needs arise out of specific problems which have been identified as being amenable to solution by the technology. Sometimes, they arise as a result of a step-by-step progression, where it can be readily seen that a small application of technology will result in improved operational capabilities. On rare occasions, the needs will arise as a result of the realization that a new technological break-through completely alters the base conditions which existed before. In the majority of these instances, user-needs will be met by the normal functioning of the market, through the supply of equipment, services, and personnel. There are a number of other areas, however, where market forces either do not operate, or where the user has a restricted choice in meeting his requirements. Examples of needs that arise in these areas are standards, education and training, availability of information, and monopoly services. All these factors point to the necessity of a government presence in the computer/communications field where there is a void to be filled.

First, governments must be continually aware of the needs of users because of the problems and opportunities which may arise from time to time in the fulfilment or frustration of these demands. For example, a special type of data communications service may be required in a particular location. Or a sudden shift in emphasis in this rapidly changing technological field may render a particular service obsolete, with consequent repercussions on the user, the industry, and the economy. Government intervention may be desirable, and in order to avoid *ad hoc* solutions at the point of crisis, a continuing awareness of user-needs is required. The type of solution required would depend on actual conditions and might range from customs duty amendments to subsidies or re-training schemes. Whatever the solution, the crux of the matter rests upon correct and timely recognition of the problem or opportunity as it begins to develop.

The second general responsibility of government is the identification of the effects of computer/communications systems on society. There may be both beneficial and detrimental effects from the application of computer/communications technology, and government must protect society and the individual from any excesses which may arise from any application. The initial requirement is to collect information and study the effects on society of the application of computer/communications technology. Second, there is the requirement for new qualitative and possibly quantitative techniques for the proper assessment of the effects. Third, government should be in a position to curtail or re-direct the development of particular systems if their implementation and wide usage would have adverse effects on society. To protect the public interest in this way, part of the information necessary for proper assessment will originate with user-needs. It is only by keeping a

perspective on, and closely following, the development and actions users choose to fulfill their requirements that the main trends in technology and its effects will become apparent.

The Task Force therefore recommends that:

Rec. 26 The Focal Point should, periodically, and in close co-operation with associations and industries, undertake identification of user needs and evaluation of the impact of existing and projected computer/communications systems on society.

(b) Pilot-Projects Serving Social Needs

The difficulties of measuring social phenomena have been discussed in Chapter III. Not only is there insufficient knowledge of the social impacts of the application of computer/communications technology, but also too little is known about the priorities to be accorded to particular systems. In one sense, these are part of the same problem, for if the social benefits and costs were known for a number of systems, they would implicitly suggest the order of priority, and would indicate the probable effects.

As an aid towards solving this problem, government has an important role to play in providing the appropriate mechanisms. One of these would be to commission a number of pilot-projects which would:

- Stimulate the advance of systems having broad social significance, so that Canadians may benefit by their wide application;
- determine the social benefits and costs of such systems so that meaningful priorities may be assigned to their possible wider implementation; and
- provide experience in the formulation and operation of computer/communications projects which encompass many disciplines, institutions, and jurisdictions.

Ideally, the initiative for such pilot-projects would originate with those communities of interest which express a desire for, and are able to participate in their development. Prerequisites for the success of a pilot-project include:

- Clearly defined objectives;
- the concurrence of the appropriate jurisdictional bodies;
- the inclusion of experts from appropriate disciplines on the project team, such as sociologists and economic analysts, in addition to technological experts;
- sufficient and appropriate measures of existing conditions;
- the utilization of regional and local resources;
- retrospective assessment after completion.

These pilot-projects should be regarded as controlled experiments, offering perhaps the best promise of guidance for computer/communications developments. While it would not be practical at this stage to delimit the possible areas of application, there are several which are obvious candidates, *e.g.*, health care, education, community information, leisure activities, manpower placement and community activities.

In order, therefore, that society may benefit more fully from computer/communications technology, the Task Force recommends that:

Rec. 27 Government should stimulate the advance of special computer/communications systems, particularly those having broad social benefits to Canadians, by making funds available through the Focal Point for pilot-projects undertaken by or in conjunction with associations, industry, universities and governments at all levels.

In making this recommendation, the Task Force recognizes that computer/communications, while being an integral and important part of the pilot-projects, are the technical means for achieving specific ends. Much of the impetus and initiative for their development must therefore rest with those other organizations which have primary responsibility in the areas of application. These organizations will be in a position to assess the degree of relevance and importance of the proposed services to be tested in the pilot-project, and the Focal Point will be in a position to assess which aspects of computer/communications are important for test and evaluation. This involvement of the Focal Point should be with the full knowledge and understanding of the federal government department, if any, having prime responsibility in the area of application. The main activity of the Focal Point in these joint ventures should be the application, in any given situation, of the knowledge and expertise gained in other areas; the organization responsible for the new development will, in many cases, already be well informed of developments in computer/communications in its own sphere of operation.

(c) Public Sector Co-ordination

As the functions of governments and other public institutions become increasingly interdependent, the dangers of isolated systems-development become more acute. Information transfer barriers may evolve which would become more difficult to surmount with the passage of time. The impetus for co-ordination, particularly among governments, may come from a realization of the community of interest that undoubtedly exists in the need for common data and information.

Canadian geography tends to impose limitations on the development of public computer/communications systems beyond the boundaries of large urban centres. The less populated areas may have difficulty in providing the necessary resources to develop their own systems. Because of high communications costs and certain differences in requirements, they may also be prevented from using public systems developed in the large urban centres. To alleviate these disparities, regional and national approaches to systems-development are required. A significant example of this kind is the move towards the sharing of resources and facilities by the provincial governments in the Maritimes.

Another example of collaboration, in this case in the United States, among a number of organizations with apparently divergent interests but common requirements regarding data is that of an economic data bank being

developed for the New England states. The supporting organizations are four banks, two electric utility companies, a state government agency, and the telephone company. The intent is to create a data bank which will facilitate and encourage research into regional economic problems. It is to be set up on the New Jersey computer of a private time-sharing company.

In the future development of systems in the public sector, greater recognition should be given to the information transfer process among governments and other public institutions; among government departments; between governments and the private sector; and between governments and the public at large. Attention should also be given to the need for co-ordinated systems approaches, and to the need for the sharing of resources wherever appropriate.

Accordingly, the Task Force recommends that:

Rec. 28 In government support of projects, priority should be given to those which involve the formation of regional and nation-wide computer systems in the public sector, designed to make available on a shared basis, computer and specialized data bank facilities to public institutions and to the general public.

(d) Research

Technological forecasts for the future predict an abundance of new techniques and equipment in computer/communications, although, in many instances, we have barely begun to make adequate use of what exists. It is, without doubt, an area of continuous innovation, with development following closely upon development at a rapid pace.

In these circumstances, the government must be able to take a position on issues; to determine where stimulation is required; to demonstrate that intervention is necessary; and to guide developments in the national interest. For all of these reasons, as well as for its own internal requirements in the computer/communications field, the government must have at its disposal an adequate level of competence, the ability to recognize the implications of developing trends, and a fund of expert knowledge on which to draw.

The Task Force considers it essential that the government should undertake two separate but related research programmes. The first relates to the long-range social effects of computers and communications, while the second concerns technological research.

Recommendations 26 and 27 were addressed to the need for the identification, assessment, and stimulation of systems which would be beneficial to Canadian society, and are indicative of Task Force concern that the effects of systems on society be understood. There is a further need, however, to take a more coherent view of the impact of the application of this technology. For while the identification of user-needs and the undertaking of pilot-projects should provide a great deal of knowledge at the micro-level,

there remains the need to place this information in perspective, and to supplement it by original research into specific areas of concern. For example, it was pointed out in Chapter III that there exists a widespread belief that computers will cause unemployment. The validity of this conjecture in specific cases should be determined in order that government may take remedial measures if necessary, and so that the general public may be reassured. Societal fragmentation in the face of technological change, and population concentration into urban areas, may be other important subjects of enquiry where the effects of computer/communications systems may have a causal relationship in the long term. These, then, would be the types of subject which should form part of the research programme into the long-range social effects of computers and communications.

An important corollary to research of this nature is the need for multi-disciplinary skills to be brought to bear on problem areas. The pervasiveness of the technology and the wide variety of applications require co-ordinated efforts from a wide range of disciplines if they are to be effective. Government must look particularly to the universities for close co-operation in this endeavour.

The Task Force therefore recommends that:

Rec. 29 In conjunction with universities and other research institutions, government should foster multi-disciplinary research on the long-range social effects of computers and communications.

As far as technological research is concerned, the Task Force believes the major part shculd be performed by private industry, especially when related to product development, and recommendations towards this end are to be found later in this Chapter. However, there is also a need for direct government involvement in research work in computer/communications, and existing government research laboratories are well suited for its undertaking. The need arises from the capabilities which government must exhibit from its position of concern for the public interest. Underlying this point, however, is the recognition that closer liaison and co-ordination are required between the operating departments of government and their research resources. The knowledge derived from a research programme must be imparted to operational officials, and particularly to those engaged in long-range planning functions.

An important part of the role for government research laboratories is to concentrate on technological areas that relate to Canadian conditions, which would include:

- The technical feasibility of incorporating communications satellites in a data network structure;
- the technical feasibility of centralized, versus distributed, networks of computers and data banks;
- the technical feasibility of hardware techniques for overcoming problems of compatibility and code conversion;
- forecasts of technological innovations, their applicability to user needs, and their likely impact in terms of cost-reduction capability.

The results of such research should be made available, not only to interested departments of government, but also to private Canadian organizations which are involved in the field.

Accordingly, the Task Force recommends that:

Rec. 30 Existing government research laboratories should include in their programmes, selected areas of computer/communications technology and make the results available to public and private organizations, for the development of techniques and applications specifically adapted to Canadian needs.

2. INCENTIVES TO SUPPORT THE SUPPLY INDUSTRY

(a) Background

Any consideration of the support that government should give to the computer/communications supply industry must acknowledge its importance to the nation; the present realities of the Canadian supply industry vis-à-vis its position in the world context; and, in this light, what may be reasonably expected of industry, in order that government policy objectives can be realistically formulated.

Throughout this report the pervasiveness of the computer has been stressed. It is expected that computers will soon be used extensively by small businesses, and eventually in the home. This essential fact that there are many applications of the computer yet to materialize re-emphasizes the point that computer/communications supply is a growth industry. Notwithstanding the economic pause of 1970-71, the overall growth rate extrapolated for the remainder of the decade at over 15%, is high by any standard. The automobile industry, for example, bases its current long-term predictions on a 5.5% growth-rate. Even if the actual growth-rate for computer/communications is not as high as predicted, most observers agree that there will be few other industries which will match its pace of development. In terms of importance to the nation, therefore, the growth of the industry implies the creation of job opportunities. With one of the most rapidly expanding working populations in the western world, Canada will be hard-pressed to find sufficient job opportunities for all, even should a dramatic change in attitude towards the work ethic materialize.

In business and industry generally, Canada cannot afford to be less competitive than other nations, and even if the effectiveness of the computer has yet to be truly apparent in many instances, there is a widespread feeling that we are about to turn the corner in this regard. The existence of some highly successful applications cannot be denied. In the public sector, the increased use of computer/communications systems may well be one of the possible methods of helping to arrest the escalation of costs of certain public services. Furthermore, there is a growing number of systems directed towards serving areas of social significance where the potential benefits, although difficult to define and quantify at present, appear nonetheless real.

The reason for stressing the importance of the domestic supply industry in conjunction with the concept of a national computing capability is that it is conceivably possible to have the capability without necessarily having the industry. The rationale for this approach suggests that all the necessary technology, equipment, and services can be bought from foreign sources at less cost to the Canadian user. All the evidence before the Task Force, however, indicates that there are no simple trade-offs which can be made; that the computing capability of the nation is inextricably interwoven with the products and services of the domestic manufacturing and supply industry; and that the fortunes of the one are highly dependent on the fortunes of the other. The service supply segment of the industry, for example, serves not only the user of in-house equipment, but also companies which would otherwise lack a computing capability geared to Canadian circumstances. In a similar fashion hardware suppliers have undertaken the manufacture of teller terminals designed for certain Canadian banking methods. Without a domestic manufacturing and supply capability, it is doubtful, in most instances, whether specifically Canadian needs would be met at all. Its importance to the nation, therefore, lies in its ability to interact with the user in providing essentially Canadian solutions to Canadian problems while at the same time providing other benefits to the economy as a whole.

(b) The Role of Multi-National Corporations

The present realities of the domestic supply industry within the world context cannot be overlooked. In terms of hardware, Canada is firmly committed to North American product lines and standards for virtually all its computing and most of its communications equipment. Apart from the products of some of the Canadian-owned entities, manufacturing is based mainly on U.S. designs. Where computing equipment is concerned, the supply is dominated by the multi-national computer corporations. In recent years, their strategies have centred upon the international rationalization of product lines, to the extent that a complete computer system may consist of units of equipment manufactured in several different countries. To some degree, the fortunes of a particular subsidiary in a particular country may depend, therefore, on the success of its unit of equipment or product line in the world market. The extent to which local management plays a role in anticipating the decline of a particular product line, and preparing for the next product development, is unknown, but probably varies between companies and countries. One of the key factors in ensuring continuity and expansion is an amount of research and development proportional to the total operations of the subsidiary. There are indications that multi-national computer corporations are beginning to allocate development and manufacturing expenditures in line with sales revenues in other countries where they are doing a substantial volume of business.

Because of the dominant position of the multi-national corporations in the computer/communications system supply function, the contributions which they have made and continue to make to the industry, and to the economy generally, are of vital importance to Canada. In order to ensure, therefore,

that Canada obtains an adequate share of research and development work, which would generate job opportunities in the manufacturing process, the Task Force recommmends that:

Rec. 31 Government should continue its efforts to ensure that foreign or multi-national computer and communications corporations with substantial sales in Canada expend appropriate sums in Canada on research and development leading to manufacturing activities.

(c) Support for Canadian Enterprises

At this stage of development, it would be unrealistic to assume that Canadian companies could or should engage in every facet of the supply of computer/communications goods and services. Nevertheless, there are a number of opportunities which Canadian companies, supported by appropriate and consistent government policies, could exploit to a greater extent than heretofore. Included among these would be: computer/communications interface equipment; terminal devices; computer peripheral equipment; computer components; computer environmental equipment and consumables; applications software; data base management software; and standardized package software. For the most part, these areas of specialty are not dependent on organizational size for their exploitation, but rather on innovative abilities, a realistic programme of development, and managerial ability to recognize, penetrate, and sustain the available and potential markets. Many excellent products in this field have been developed by dedicated teams of individuals, brought together by a high quality of leadership. For a number of reasons, often related to the size of the company and its capital resources, they have failed to exploit fully the potential of the product or service.

Of particular concern in this context are the software developments of Canadian enterprises. These undoubtedly represent an area where the expertise is available; where the products are internationally competitive, at least in quality; and where the market is still sufficiently fluid that it is not too late to capitalize on both the available and anticipated opportunities. The first point to be made is that software can be, and frequently is, as much a tangible commercial product as any item of hardware. Second, while there is still a lack of user acceptance for much of the commercially-developed software, the re-evaluation of in-house computing which is now taking place could result in a change of user attitude towards these products. Third, there are a number of advantages in using commercially-developed software which have not been sufficiently impressed upon potential customers. These include; reduced in-house personnel costs; faster development and implementation; training, maintenance, and documentation provided by vendors; and increased flexibility due to the provision of more program functions than are required initially. Much of software development should be considered as an appropriate innovative product meriting support, in the same manner as hardware. At the same time, Canadian entrepreneurs must be fully aware of the necessity to produce ''saleable'' software products. This often intangible quality would include; the identification of market needs; a sound marketing capability; the uniqueness and quality of the software; a pricing structure

appropriate to the investment and pay-off period; and an ability to instill in the customer the need for adequate operating, training and software maintenance practices.

In Chapter V, reference was made to the problem of lease-capital financing for Canadian companies. The problem is particularly acute for Canadian manufacturers who are attempting to obtain a foothold in a market which traditionally favours leasing arrangements for hardware products. Even when sufficient venture capital has been obtained to develop, manufacture, and sell the product successfully, the working capital required for continued operations during the initial years is greater than the revenues derived from leased products. Because it is probable that the private sector particularly, will continue to favour lease rather than purchase, consideration by government should be given to support arrangements for the financing of hardware leases.

Because of their importance in this innovation-oriented industry, Canadian entrepreneurs should be afforded ready access to government incentives which will enable them to overcome the costly barriers of the development phase and the subsequent marketing phase. Accordingly, the Task Force recommends that:

Rec. 32 Incentives should be granted to Canadian enterprises for all phases of innovation in the computer/communications field, particularly in application software and ancillary equipment development.

(d) Customs Tariffs

Concurrent with the necessity to establish policies relating to support for the domestic supply industry, based on a realistic appraisal of its international position, is the need to establish complementary policies for customs tariffs for hardware and computer service products.

There are two main problem areas. First, there is the classification of computer/communications products for tariff purposes. Many items within a complete system fall under different categories, resulting in a range of applicable tariff rates from zero to 20% of the value of the items. As a consequence, arbitrary rulings sometimes occur whereby identical pieces of equipment are tariffed under different classifications. This, in turn, makes it difficult to assess statistically the nature of the imports of computer/communications equipment and components. Second, there is the broader problem of the purpose of the tariff and the protection it affords. In general, the application of the tariff raises the cost of computing in Canada both to in-house users and to service bureaux in the service supply segment. On the other hand, it is intended to provide protection for Canadian industries which are manufacturing end-products and components in the field. On the surface, there would appear to be a case for revising such tariffs on all equipment of a type not manufactured in Canada, and particularly on large-scale computer systems. This would ensure that the service supply segment could compete on a more equal footing with services offered from foreign countries. However, it must be acknowledged that this is an over-simplified solution of a very complex problem.

The Task Force has had neither the mandate to investigate this problem, nor access to the confidential corporate information that such an investigation requires. Accordingly, the Task Force welcomes the government's direction to the Tariff Board to examine this area; to report its findings; and to make recommendations, where necessary, to amend such tariffs. In the light of the rapid changes in technology, a periodic review may be necessary.

3. EDUCATION AND TRAINING IN COMPUTER/COMMUNICATIONS

According to user and supplier responses to Task Force investigations, education and training in computer/communications and related information-systems technology is widely recognized as one of the key factors which will determine the extent, efficiency and effectiveness of computer/communications application systems in use throughout the nation and, indirectly, the development of the national computer/communications industry. Similar studies in other countries, such as the United States, Japan and Germany, have also placed emphasis on this subject.

(a) Needs in Education and Training

The rapid growth of computers in Canada over the past 20 years has placed a heavy burden on users and designers of computer systems to gain and maintain knowledge in this field. Apart from the great difficulty for computer professionals to keep abreast of the current technology, the rapidly expanding industry has created an increasing number of jobs to be filled; and the lack of perspective on employment opportunities has resulted in an oversupply of specialists in some fields. All these problems have created a confused situation. Many users and professionals have gained their knowledge primarily through training provided by hardware manufacturers, professional associations or training seminars offered by consultants, and, to a lesser degree, through formal college or university education.

The early sixties saw the emergence of high-level computer languages such as FORTRAN, COBOL and others. New hardware with emphasis on greater input/output flexibility became available. Operating systems and software packages increased computing capabilities immensely. This fast pace of new development put a considerable strain on computer professionals to absorb new knowledge and placed emphasis on technological aspects in training programmes. This emphasis shifted the spotlight from the computer generalist, more concerned about user problems, to the hardware-oriented specialist, more concerned with computer throughput. This development, while beneficial to the explosive growth of the computer industry, has been at the root of the gap between users and computer professionals.

Consolidation of previously decentralized computer facilities and central control of EDP departments within the larger user organizations have brought new problems, but have also provided new opportunities both to users and computer professionals. Consolidation of facilities has also opened new prospects in information systems integration, using data banks and terminals. Unfortunately, the very pace of this evolution causes a gap of understanding

between users and computer professionals which cannot easily be bridged without an educational programme directed to both. The following needs were identified:

- An increased level of understanding by users of the role that advanced technologies will play in their organization;
- a broader perspective by computer specialists of the structure and operation of business, industry and society, to enable them to be more responsive to user needs;
- a greater in-depth knowledge on the part of computer specialists of new technologies and methodologies, such as data communications and data management;
- an introduction to computer/communications at an early stage in the education process, to prepare students for future contact with these technologies.

(b) Fragmentation in the Provision of Education

A wide variety of organizations has become involved in attempting to satisfy education and training requirements for computer/communications. These organizations include universities, institutes of technology, community colleges, private schools, manufacturers, professional associations, and, not least, the computer user-organizations by means of their in-house training schemes.

The universities were among the first to teach computer technology, particularly in the applied sciences. They remain pre-eminent in the teaching of the theory and underlying principles of computation, and most universities now include computer science courses in their curricula. Computer science has been described as "the systematic study of constructive methods — algorithms — and of systems for the automatic performance of such algorithms".[1] Because the Task Force has been concerned primarily with the fulfilment of needs through the application of computer/communications technology, no attempt has been made to assess the contribution of computer science education. However, a number of representations to the Task Force by business users suggest that computer science graduates who intend to follow careers in an industrial environment would benefit from, and would find more job opportunities in being exposed to a wider range of business subjects.

The evolution of computer systems training began with hardware manufacturers as early as the nineteen-fifties. Their purpose was to ensure that customer personnel would be able to make use of their equipment. As a result, hardware manufacturers have laid the foundation for the evolving education of programmer and systems-analysts. In recent years, new products, services and software packages required a broadening of the range of courses by manufacturers and other suppliers. Manufacturers continue to be an excellent source of education, both in general courses and in courses on the advanced use of new products and technologies.

[1] Samet P A "Insight Not Numbers" *The Computer Journal* Vol 15 No 1 p 88

Associations which have been formed for the purpose of fostering professional interest in the use of computers also contribute to the educational process. Among these are: The Canadian Information Processing Society (CIPS); the Data Processing Management Association (DPMA); the Association for Systems Management (ASM); the Canadian Management Centre of the American Management Association (CMC-AMA); and the Data Processing Institute (DPI). The most active of these in an educational role are DPMA and ASM. DPMA offers, through the auspices of certain educational institutions, courses leading to examinations for a certificate in data processing (CDP), and for a certificate in business programming (CBP). ASM also offers courses in systems and procedures and an EDP user-management introductory course. CMC-AMA conducts workshops and seminars in all management subjects, and many are focussed upon aspects related to computers. DPI (for federal public servants engaged in computing), CIPS, ASM and DPMA, hold regular meetings at the local level to discuss topics of interest and concern to their memberships. ASM and DPMA provide seminars in co-operation with their respective international headquarters. Lack of funds to support their educational objectives, absence of adequately researched job profiles for professionals, dependence on international headquarters, and lack of an adequate membership base outside the major centres of computing are problems to some of these associations in furthering education and training in computer/communications.

In-house training facilities of the larger user organizations became an important source of education and training for programmers, analysts and users during the early sixties. Nearly two-thirds of the companies interviewed by the Task Force offer some form of training to their employees. In many cases, instructional material is purchased from commercial U.S. sources or from computer manufacturers. However, the small size of many Canadian organizations prevents the establishment of sufficiently comprehensive in-house training programmes.

The shortage of computer professionals during the sixties led to the establishment of a number of private training schools. However, they have been subject to criticism as their graduates were absorbed into the market. While they are registered in each province, little or no control is exercised over course content or entry qualification. The exception is Quebec, where the Department of Education established strict qualification requirements for private-school licensing. As a result, only one private computer school has been granted a licence in that province. Elsewhere, control over the application of aptitude tests, course content, qualification of teaching staff, and course fees with value received, still remain problems.

Computer graduates from Community Colleges, CEGEPs and Institutes of Technology are generally highly regarded, and their training seems to meet needs of business and industry. Many managers of computer operations suggested that programming aptitude tests should be given by these colleges as part of the entrance requirements for programmer education to further improve the quality of graduates.

There is a modest beginning in the teaching of the fundamentals of computer technology to students in the secondary levels. High-school courses are beginning to aid in the training of operators of computers and peripheral devices. Leaders in business and industry expressed the view that the current level of computer/communications education at the secondary level requires considerable extension. As an increasing number of high-school graduates on entering the work force are exposed to computers in their daily work, any lack of exposure to the technology will make them initially less effective, and place the burden of their training on the employer.

(c) Employment Requirements

In general, long-term growth predictions for industries assist in keeping manpower supply in line with demand. However, the complexities and rapid development of the technology and the resulting rapid changes in job profiles have made this extremely difficult in regard to computer/communications.

There are a number of established broad job classifications, such as programmer, analyst, key-punch operator, but the scope of jobs seems to vary considerably by industry, by size of operation, and by interpretation of job-profile given by senior management. The task of the educator, in estimating future requirements both in regard to numbers and types of qualified personnel, has been enormously complicated by lack of information on required job-profiles.

Several attempts have been made by professional associations to determine job-profiles in Canada. However, with the limited resources available for this task, the results of these efforts have been disappointing.

A parallel situation exists in general education at the primary and secondary level. It is a safe assumption that most of today's school population will be required to interact with computer/communications during their life. Familiarity with the nature and use of computer/communications will be important in the economic and social life of the next generation.

(d) Conclusions

The interest of professional associations in training and education for effective use of computer/communications has already been mentioned. A need for greater co-operation between the educator responsible for providing the training in computer/communications, and the established professional responsible for developing job-profiles was recognized in 1969 by a study team of the Montreal Chapter of ASM, which recommended an Institute for Information Systems Training. An independent submission to the Task Force made a similar suggestion. The creation of the Canadian DPMA Institute also indicates the needs.

In recognition of the contribution that associations can make to education in the computer/communications field, the Task Force recommends that:

Rec. 33 Government should support professional and industry associations in their endeavour to organize and stimulate the provision of suitable training programmes in the field of computer/communications in collaboration with educational institutions.

Management of user organizations see the need for systems-analysts, who, besides having the technical background, would have a broader perspective of economic and business systems, problems and issues. They see the need for emphasis on problem-solving capability and on economics, management and behavioral science. The co-operative courses provided by some universities, which expose students to the practical aspects of systems problems in the working environment, will assist in providing a broader understanding of problems and requirements of users.

There is also a need to develop a broader range of courses to teach the multi-faceted aspects of computer/communications. The broadening base of technology requires increasing specialization of professionals into such areas as data communications or data management. There is also a need to provide opportunities during education in other disciplines for obtaining some familiarity with computer/communications systems. Doctors or lawyers, as well as managers in business and industry, might benefit from an appreciation of the capabilities of computer/communications systems for use in later professional life.

There is also a need for courses in continuing education for general management and for some professions, which would introduce some of the technological aspects of computer/communications, and would place emphasis on evaluation of information requirements and on the use of planning and development techniques for information systems. These courses would help bridge the communication gap between the user and the computer specialist.

Similar needs exist for computer specialists in the form of "state of the art" extension courses to maintain the competence of the practising professional. This suggests training in the practical and cost-effective application of emerging technologies, products, methods and standards to new and improved information systems.

In view of these requirements, the Task Force recommends that:

Rec. 34 Government should encourage post-secondary educational institutions to offer courses on the multi-disciplinary aspects of computers and communications systems.

As outlined in more detail in the study "Applications in Education" (Volume II), there is potential for the application of computer/communications systems in educational processes. Although it is not the usual argument in support of computer-aided learning (CAL), if CAL was introduced into the lower grades,

students would have early experience in interacting with computers which would be of benefit as computers become more integrated into every day activities.

In the administrative area, an interesting result from experimental systems, such as the Peel County pilot-project, has been the basic acceptance of this technology by students because it is possible to bring information to them which is more closely timed with activities as they occur. The presence of such systems serves also to raise their level of awareness of computer/communications.

However, there is still a great deal of research, development and testing to be done in order to decide where and how computers can be integrated effectively into the educational process. Accordingly, the Task Force recommends that:

Rec. 35 **Government should encourage research and development into the use of computers at all levels of education, through co-ordinated funding on a multi-disciplinary basis and extension of existing programmes in technological development.**

4. COMPUTER/COMMUNICATIONS STANDARDS

The importance of standards in computer/communications is widely recognized, and a high degree of concern was expressed by users and suppliers in regard to present problems in this area. One of the major problem areas will require a reconciliation of the often-conflicting interests among various groups, such as carriers, users and manufacturers, in the standards-setting process. Users view standardization as a means of rationalizing development and operations of computer applications systems and, as such, it has tangible economic value to them. The main benefits are the reduction of duplication, fragmentation and proliferation of development effort, fewer uncertainties in the expected results of such efforts and the assurance that the many systems components (hardware, software, communications facilities) and the methodology of development and operations are sufficiently compatible with each other to function as an integrated system. More than two-thirds of the interviewed users have developed and adopted some kinds of standards for internal use, and about the same number favoured some form of government support to the standards-setting process.

Some suppliers see standards-setting as a means for the smaller business to gain easier entry in the national and international markets and as an opportunity to supply particular components, either hardware, software or services to the overall computer/communications system. In either eventuality the user will benefit ultimately.

As the principle user of computer/communications systems, the federal government has an important role in the standards-setting process. When used in procurement, standards can be an aid to the development of a national industry and an effective tool to bring the industry closer to the real needs of

its users. The efforts of Commander Grace Hopper to standardize on COBOL in the United States Navy is an often-quoted example in the data processing community of how the power of government can be exercised for the benefit of the community. Support of national and international co-operation is also viewed as an essential role of government, especially in a world where there is a danger of evolving invisible trade barriers. The preparation of standards in Canada cannot be undertaken in isolation from standards developed in other countries. The nature of computer/communications technology makes the fact of geographic location unimportant to end-users. Overlaps exist in the activities of the International Organization of Standardization (ISO) and the International Consultative Committee for Telegraphy and Telephony (CCITT), and it is conceivable that conflicting standards may be recommended, complicated by the possibility that the U.S. organizations such as the American National Standards Institute (ANSI) may establish yet another set.

The present state of the evolution of computer/communications networks has added urgency to the need for a cohesive national standards-setting activity, not only in respect to computer/communications interfacing standards, but also to adequately cover the ramifications of network operations into product-, methods- and data-standards and practices. With regard to interfacing standards, for example, the data processing components derive principally from the computer industry, while the data communications systems and components derive from the telecommunications industry, and incompatibilities are common.

In discussions with the Canadian computer/communications community, the Task Force gained the impression that standards-setting and subsequent acceptance by the community in the Canadian environment will be a delicate task. The majority of users have already developed individual standards and practices for internal use, often at considerable expense, and the conversion costs to common standards, ultimately necessary for network operation, may be found to be a most formidable barrier. There is also concern that the early setting of standards for products and methods which have not yet reached technological maturity may reduce the rate of innovation and hinder rationalization. Further, manufacturers and suppliers who have already reached a dominant position in the market may view common standards as not being in their own commercial interest.

In order to achieve a cohesive standards-setting process in Canada, leading to generally accepted standards, wide involvement of users and suppliers is necessary, with more active participation by government.

As a major user of computer/communications, the government should increase its participation in this area beyond its present involvement with ISO, CCITT and the Canadian Standards Association (CSA). In addition to increasing its activities in these organizations, other considerations, such as the role of government as an official national representative in international data communications standards organizations, the impact of regulatory aspects of telecommunication on standards-setting activities, and legislative aspects

related to standards on privacy and information security, suggest a need for co-ordination within government, between governments and with other standards-setting organizations.

In Chapter IX, a distinction was made between standards in the broad sense, and specifications drawn up by the carriers. It was also pointed out that the common carriers should have responsibility for the development of a data communications network, with the Focal Point ensuring that such development does not lead to disadvantages to users which could be caused by incompatibilities in the communication services offered. This then places an additional responsibility on government, and in order to assist in attaining this objective and to overcome some of the problems described herein, additional emphasis is placed on the need for government to participate actively with industry management in the standardization process.

In view of the range of activities associated with standards-setting, the Task Force recommends that:

Rec. 36 The Focal Point should co-ordinate the participation of the federal government in national and international standardization activities relating to computer/communications and in conjunction with provincial governments, industry and user associations, promote the preparation, publication and adoption of standards for an orderly and coherent growth of computer/communications in Canada.

An important part of the extended role envisaged for CSA relates to data communications standards, particularly in regard to interconnection of networks. In order that CSA would be able to carry out its additional functions in the computer/communications industry, a well-balanced representation from users and suppliers in the committee structure is required. However, since committee members are volunteers and there is no reimbursement to their company for time lost and expenses incurred in the work of standards preparation, the resulting financial burden is more than the smaller organizations can carry. Similar observations apply to international committee activity and to delegations to international conferences. Recently, the Standards Council of the federal government has made international travel funds available to CSA. In view of the extended role of CSA recommended by the Task Force, it is therefore proposed that:

Rec. 37 Government should provide funds in order to increase the participation of user groups in the formulation of standards, and place increased emphasis on communications, particularly in regard to interconnection of networks.

5. GOVERNMENT AS A USER

So far, in this part of the Report, recommendations have indicated measures governments can take which are specifically directed at creating a climate favourable for the development and application of computer/communications

in Canada. No less important in this regard are the actions taken by government departments and public institutions at all levels of government, in their own data processing operations.

Unless national policies are carried through to the operational level of individual departments and agencies, much of the credibility and impetus of these policies will be lost. This becomes particularly clear when one considers the large percentage of public sector activities compared to the total of EDP activities in Canada, as shown in Figure 6, Part A.

While the Task Force has been looking at the national scene, two other investigations have been carried out on the internal computer and communications requirements of the federal government. The EDP Policy Project of the Treasury Board, which was initiated in February 1971 to look into certain aspects of electronic data processing in the federal government, published its report in the spring of 1972. At the same time, a survey was conducted by the Government Telecommunications Agency in the Department of Communications, to obtain information on government use of telecommunications facilities; data communications was only one aspect of this study.

The report of the EDP Policy Project[2] shows an expenditure of over $80 million for EDP requirements in 1971. It also emphasizes the rapid growth-rate (26% per annum) of these expenditures over the past 10 years, and the rapid increase in EDP personnel over the last four years — 15% annually, as compared with about 3% annually for the total public service. In spite of the rapid growth, present EDP costs represent not more than 1.6% of the total operating budget for federal departments.

The report forecasts an increase in annual expenditures to about $175 million in 1975, if the policies recommended in the report are implemented. At the same time, it is expected that personnel connected with EDP will increase from about 5,000 today to about 8,000 in 1975.

Expenditures incurred by the federal government on external computing facilities (commercial and universities) have increased from about one million dollars in 1967 (which was about 3.5% of total EDP expenditures) to about $7 million in 1971 (which represented about 8.5% of the total EDP expenditures in that year). It is expected that this proportion will continue to increase. It might be mentioned that expenditures by the U.S. Federal Government (less military and other classified systems) for services on external computing facilities amount to about 14% of the total EDP expenditures.[3]

[2] *Report on Electronic Data Processing in the Federal Government of Canada* (EDP Policy Project Administrative Policy Branch Treasury Board Secretariat November 30 1971)

[3] See data contained in: 'IMPACT 70 s (Illinois Master Plan Applying Computer Technology in the 70 s) Volume II: Detailed Development (Illinois Department of Finance. Management Information Division (submitted to Governor Richard B Ogilvie))

Based on Government Telecommunications Agency figures, the Task Force estimates that federal government expenditures on data communications in 1970 represented about 7% of the total data communication revenue of the carriers in Canada. It is expected that these expenditures will about double by 1975, at which time they will represent about 10% of the total Canadian figure.

(a) Alignment with National Policies

Unquestionably the whole computer/communications industry is strongly affected by such public activities, and the federal government, as the largest single user of computers and communications in Canada, can exert considerable leverage on the direction and rate of development of the industry through its operational policies.

Operations in government cover a wide range of activities which touch on many of the technological aspects and applications of computer/communications. In particular, government activities in the following areas, which are considered below, will have significant impact:

- Standards for hardware and software;
- standards for information handling, data coding, and information format;
- training for line management as well as for data processing personnel;
- social systems;
- regional development;
- procurement policies.

Because of the magnitude of government usage of computer/communications and the potential impact on the industry, the Task Force recommends that:

Rec. 38 Steps should be taken to ensure that the policies for internal federal government data processing and data communication activities are continually related to national policies in the computer/communications field.

While this recommendation is specifically addressed to the federal government, it is suggested that concerted lines of action should be developed also with Crown corporations and other public institutions at all levels of government. Standardization and training are also extremely important to the internal operations of government departments.

The co-ordination implied in the recommendations of the EDP Policy Project report places greater emphasis on government-wide standards for hardware and software. Standards activities within the government, which might be co-ordinated under the auspices of the Canadian Government Specifications Board, must be aligned with standards policies and other activities of the Canadian Standards Council and the Canadian Standards Association. In particular, with regard to drawing up specifications for tender, the government could play a leading role in the adoption of new standards.

Another area which will probably receive greater attention under the new policies is that of co-ordinating methods and procedures for information-handling and for its transfer across departmental boundaries. The work done in this area, and in standardizing data codes and information format, would also be of value in the exchange of information between governments and between government and industry. It would therefore be advantageous to take cognizance, where possible, of industry and provincial needs and constraints and possible solutions, when considering some of the internal requirements of the federal government.

The Public Service Commission has also devoted much attention to the training requirements in EDP. Many of the problems and needs in the federal government, provincial governments and industry are similar, and some joint action may be possible in, for example, developing certain training profiles and course-programmes, which might then be implemented by professional associations in conjunction with universities and colleges.

In addition to these examples which cover, primarily, the technological aspects, there are three other areas which will be considered at greater length.

(b) Social Significance of Government EDP Systems

Of particular importance in the national scene is the social impact of systems developed for departmental programmes. It is beyond the scope of this report to consider the social implications of all the computer systems in the federal government. The following examples help to illustrate the pervasive nature of the applications and the leverage that the government can exert in the development of socially-desirable systems, as indicated in recommendations 26, 27 and 28.

The Department of Supply and Services is one of the major users of EDP facilities in the federal government, with an EDP budget in excess of $10 million for 1971-72. It is responsible for issuing about 9 million cheques per month, and is, at the present time, studying the feasibility of direct transfers of money to individual banking accounts. Such an action would be a step towards the ''cheque-less'' society, and would need to be co-ordinated with systems-development in the chartered banks.

The Department of National Health and Welfare is responsible for the Canada Pension Plan, the computerized operations of which are handled by the Department of Supply and Services for over 8 million contributors. The Department of National Health and Welfare is also interested in additional uses of computerized services in health care delivery systems in Canada.

Automation of the national bibliography and the cataloguing sub-systems of the National Library is to commence, in 1972, as the start of a planned joint long-term and large-scale computerization programme of the National Library and National Science Library computing facility which will be used by both national libraries, and eventually will cover all government library data

processing needs. A recent report[4] has suggested that the Urban Information Exchange Service "would form, together with its various components, a subnetwork of the Canadian Scientific and Technical Information Network".

This last example illustrates the possible ramifications of federal government developments, and their application to other requirements. In view of the wider applicability of systems already developed, or to be developed, in government, it would be advantageous, where possible, for departmental plans to be published.

Operational policies of federal government departments can have a strong influence on the development of regional computing capability, particularly through possible shared use of local facilities by the federal and provincial governments. The possibility of dispersing the federal government's computing operations in order to assist regional development raises many of the classical considerations surrounding centralization versus decentralization which include: the purpose or purposes of the system; economies of scale; systems-design considerations; communication costs; availability of expertise; the types and levels of service required; and the costs associated with systems-development.

If a computer system for a particular department is considered in isolation, and if trends continue towards the use of larger processors, accompanied by a decline in communication costs, and an increase in the ability to manipulate large files of information, then there may be a tendency to accentuate centralization.

If, on the other hand, a department's computing requirements are considered in relation to local requirements, and if emphasis is placed on providing service in the field, there may be a tendency to decentralize certain operations, using central facilities only for summarizing and collating information on a nation-wide basis. Such decentralization, combined with joint projects with provincial authorities could materially assist in some aspects of regional development, and would promote useful opportunities for shared experience.

Where it is possible to decentralize certain EDP operations, the federal government should consider the feasibility of utilizing local service bureau facilities, in order to stimulate regional development of the computer/communications industry. This should be done in consultation with local provincial authorities, so as to develop a concerted approach.

(c) Procurement

The EDP Policy Project report, in itemizing "key problem areas", points out that "Because of several recent industry and technological developments, there are many areas in EDP procurement that are not adequately covered by

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[4] *Information for Urban Affairs in Canada* (Ottawa, Canadian Council on Urban and Regional Research, 1971)

present policy. Among these are: use of computer service bureaux, obtaining of peripheral EDP devices from suppliers other than those supplying central processors, acquisition of computer software, and use of communications-based devices.'' Each of these areas will be considered below, for it is in these areas especially (where procurement policies need to be clarified) that there is particular potential for development in Canada.

Government procurement policies and practices can have wide-ranging effects on computer/communications in Canada. Direct effects include:

- Providing a market for computer/communications hardware and software developed and produced in Canada;
- strengthening Canadian-controlled firms, particularly in applications involving sensitive information;
- development of systems of national scope which may be co-ordinated with provincial and private sector activities;
- providing a market for the development of commercial computer/communications services in regions of low industrial activity.

Indirect effects include:

- Development of standards for hardware and software;
- development of standardized data codes and information format;
- raising the level of Canadian industrial expertise in application programs, application hardware, and systems-design.

Accordingly, the Task Force recommends that:

Rec. 39 Federal government policies for the procurement of computer and communications goods and services to satisfy the internal needs of departments, should be directed towards the greatest possible stimulation of the computer/communications industry in Canada.

In particular, it is recommended that departments, while maintaining a high degree of professional competence internally, should increase, to the greatest possible extent, their use of commercial service organizations. The particular importance of the services supply segment of the industry has been outlined in Chapter X.

The EDP Policy Project report recommends that ''Government policy for EDP be to meet its needs for EDP equipment and services from the private sector except when it is in the public interest or it would be more economical to provide them internally'', which is in general agreement with the above recommendation.

Use of Computer Service Bureaux

Individual departments must retain sufficient professional expertise, and must be provided with the equipment necessary for carrying out their mandates. Notwithstanding this overriding requirement the Task Force is concerned that

some — perhaps much — of what is now done internally by increasing staff and acquiring additional equipment could be accomplished by contracting with commercial services in Canada.

If a high level of security is required, or some other particular need exists, it may be very difficult for departments to relinquish, even partially, control over the full operations of a system. However, in other cases, where a department is servicing some of its own internal operations and where security requirements can be met by commercial organizations, consideration should be given either to contracting out this work, or, in some instances perhaps, to facilities management.

In developing policy guide-lines for deciding on whether to build up internal staff and facilities or whether to purchase the required services, it should be borne in mind that direct purchase of services is perhaps the most logical (and least expensive) means of supporting the data processing services industry in Canada. Industry support programmes of the Department of Industry, Trade and Commerce place prime emphasis on research and innovation and cannot easily be modified to support the provision of available services.

The basic concern in deciding whether to provide services internally or obtain them externally, and in the selection of external services, must be to obtain the best overall services at least cost to support government operations and programmes.

The EDP Policy Project report has already emphasized that "In considering the relative costs of providing service in the government and obtaining it from the private sector, full costs should be accounted in each case." A definition of "full costs" is necessary to ensure consistent implementation of the policy.

Departments should avoid the acquisition of services which would entail the transfer of information outside the country. It is not possible to be dogmatic on this point, for in some circumstances — particularly in some scientific applications — it may be in Canada's interest to use highly specialized data bank facilities or other special services outside the country. Such a decision, however, should be based on an analysis in which the national interest is paramount.

In addition, provided a Canadian-controlled firm offering data processing services can meet the requirements of the user department, preference should be given to such a firm, based on a case-by-case decision. Where the data to be processed are of a sensitive nature, Canadian control should be a mandatory requirement.

Particular attention should also be paid to the possibility of utilizing commercial service bureaux as regional data processing centres for federal government requirements, in order to provide a base workload for a regional computing capability.

Peripheral EDP Devices

The Department of Industry, Trade and Commerce, in its support programmes for industry, already takes into account the "corporate behaviour" of firms in Canada. Consideration should be given to purchase of equipment developed under PAIT or other similar industry support programmes. Use of such products by the Canadian Government could assist in introducing them into the market-place. This of course, does not preclude consideration of those Canadian-developed products not assisted by government grants.

So that peripheral and terminal devices may be purchased from suppliers other than the one supplying the central processor, much greater emphasis will need to be placed on standards development for government operations aligned with national standards activities.

Acquisition of Computer Software

A distinction is made here between machine-oriented software, such as the executive and other operating systems, and application-oriented software. The former, to a large extent, may be considered as being very similar to hardware in regard to procurement. There are, however, some differences in that there is more reason and more opportunity for in-house development of this type of software than there is for in-house development of hardware. It is, however, inconceivable that all government departments should see a need to become involved in this type of development.

On the other hand, virtually all departments are concerned with the need for application software to meet their particular operational requirements. There are, for example, a number of different software systems handling personnel requirements. Such fragmentation and, to a certain extent, duplication of developments, should be of concern to government. It is of particular importance to the development of a computer/communications industry in Canada that more of this work be contracted to the private sector. Policies need to be developed which will minimize duplication and enforce adherence to government standards for data codes and information format. In the United States, government contracts have been used to great advantage in developing software expertise in the private sector.

Data Communications

It has been recommended (Recommendation 13) that non-carrier organizations be permitted greater freedom to attach equipment to carrier facilities, thereby improving the quality and efficiency of data communication services. This will open up new opportunities for the private sector in Canada, and will provide a wider variety of choices, both in regard to equipment and services for the users in government.

It is a general practice in the computer/communications industry to supply equipment such as data communications terminals on a lease basis. This has led to the smaller supply firms getting into difficulties in financing. Commercial

users probably welcome the practice as an aid to their tax structure. Government could consider outright purchase, in order to assist in reducing the capital requirements of the vendor. At the present time the decision to lease or buy depends mainly upon a cost-analysis by the department which is funding the contract, although it is also influenced by other factors, particularly the capability of the vendor to provide adequate maintenance support, and problems of obsolescence in a rapidly-changing technology. If national policies are directed towards stimulation of Canadian industry, recognition of this problem in the "lease or buy" policy is indicated, possibly favouring, in appropriate cases, outright purchase, even if a certain premium would have to be paid.

Several references to pilot-projects for computer/communications are made in this Report. A new digital network, being tested by TCTS, is a special case regarding which the initiative is from outside government, and government is only one of several users. The published results of this testing will be analyzed by government, and considered in relation to its requirements. However, there is at present no specific mandate for experimental work for the development of government data communications networks. In formulating policies for the procurement of data communications facilities and services, the need for such experimental work should be borne in mind, with particular emphasis on the evolution of a co-ordinated data communications network in Canada. In conjunction with the carriers, for example, it may be possible to test different types of equipment, different techniques, and perhaps new tariff structures for data communications, on an experimental basis, which could not be tried on a public network because of regulatory or other requirements.

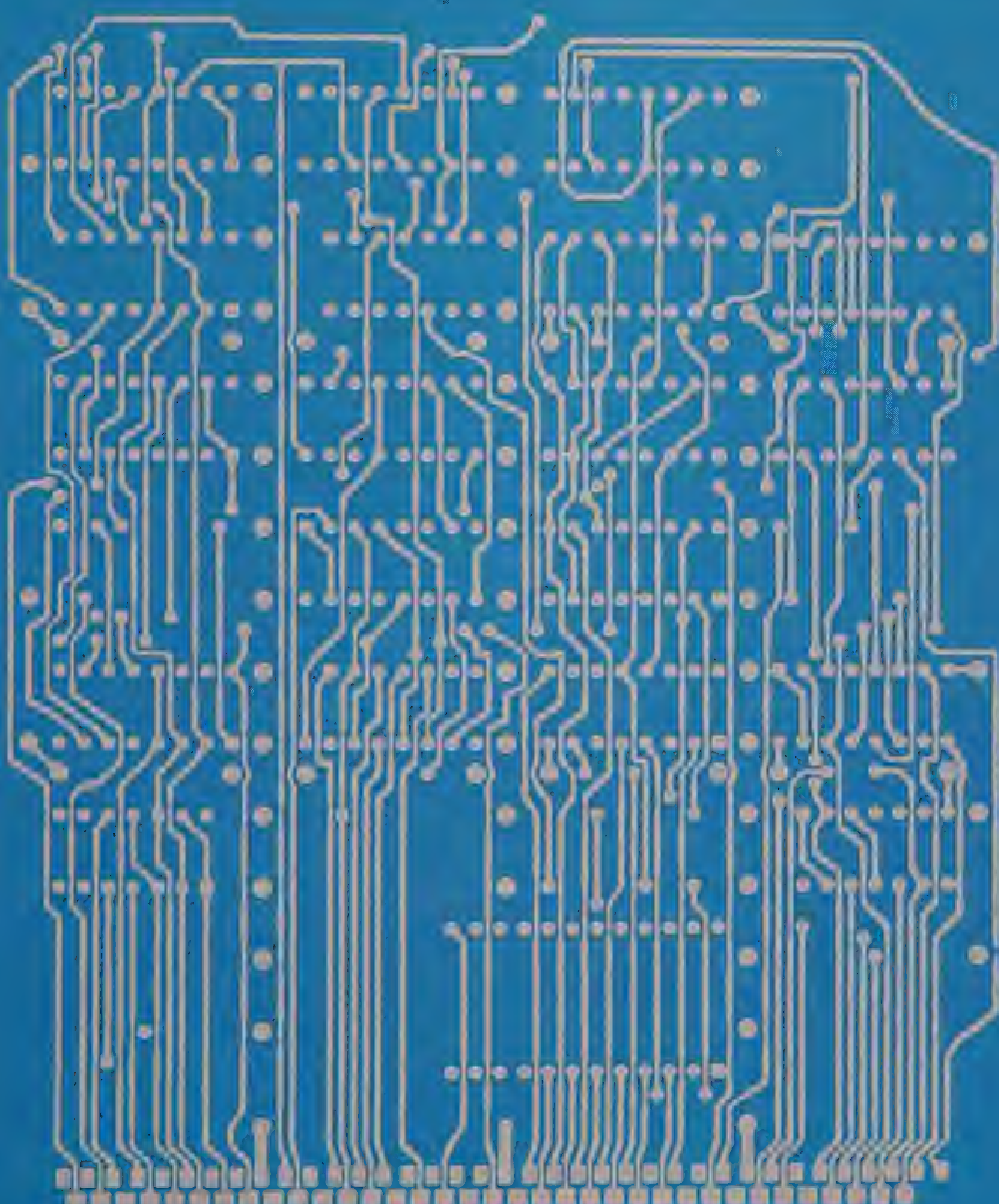
It may also be possible to develop a network within the government framework for a number of departments, which could act as a pilot-project for nation-wide network development.

The above suggestions indicate that measures may be required to ensure a unified response by all departments to national data communications policy, particularly where such policies may be in conflict with short-term budgetary objectives of individual departments.

Part

E

Institutional Arrangements



Chapter XII
Role of Institutions

This Report thus far has concentrated on functional requirements, with little indication of the appropriate institutions for carrying out the different activities. Attention is now given to those institutional measures which are considered necessary for the implementation of the recommended policies.

This chapter describes the need for certain institutions, and for new institutional arrangements in the light of the functional requirements of computer/communications. First, attention is given to the means by which the many viewpoints within the federal government could be brought together for the formulation of co-ordinated federal policies. This is followed by a discussion on the need for federal-provincial collaboration. Finally, government-industry relationships are addressed, and a number of bodies are described which are seen to be the most appropriate means for planning, stimulating, and, where necessary, regulating, activities in computer/communications.

Because the complexities of the technologies under review reflect equally complex situations at the institutional level, Section 4 is devoted to a further explanation of the proposed institutional arrangements. The recommended institutions are depicted in chart form, in order that their inter-relationships may be more easily understood. The notes accompanying these charts indicate in more detail some of the functions envisaged for these institutions.

1 RELATIONSHIPS WITHIN THE FEDERAL GOVERNMENT

(a) The Need for an Interdepartmental Committee on Computer/Communications

Recommendations presented in the preceding chapters dealt with functions which fall in the area of responsibility of different federal departments or agencies. In such cases computers and communications form individual elements in a broad range of subjects under the particular mandate of a department.

Departments, or agencies, thus involved include:

Department of Communications
Department of Consumer and Corporate Affairs
Department of Finance
Department of Industry, Trade and Commerce
Department of Manpower and Immigration
National Research Council of Canada
Department of National Revenue
Department of Regional Economic Expansion
Department of Supply and Services
Ministry of State for Science and Technology
Treasury Board Secretariat

This list, which is by no means comprehensive, is given to indicate that policies touching on computer/communications fall within the purview of many different departments.

As in other fields of policy-development which cross a number of departmental areas of responsibility, an interdepartmental committee should be established for co-ordinated discussions and decisions on all matters

pertaining to the development of national policies in computer/communications. Such a committee would, in all likelihood, cover other areas of telecommunications, but reference is made here only to those aspects which concern computer/communications. A mechanism of this type is necessary, in view of the number of different departments affected by the recommendations in this Report.

(b) The Need for Computer/Communications Expertise and a Focal Point

The issues of computer/communications represent a highly complex mixture of technical, economic, social, jurisdictional, and institutional problems, which are all inter-related and, in addition, are subject to rapid change. This suggests that there is a requirement for a permanent centre of expertise in which the many interacting issues can be continually monitored and analyzed for presentation and advice to those responsible for policy-decisions. This concept led the Task Force to the basic Recommendation 4 which proposes that, in the area of federal responsibilities, a Focal Point should be established within the federal government to co-ordinate the development, formulation, and continuing evaluation of national policy in all matters pertaining to computer/communications. This Focal Point would be in close contact with industry and appropriate groups in provincial governments; it would provide inputs to the inter-departmental committee, and perform studies and investigations as they become necessary for the committee's work.

The functions of the Focal Point fall into two broad categories:

- Strategic planning; for the formulation and review of national policies and objectives, for the identification of needs, and for the evaluation of impacts on society; and
- programme co-ordination; for assisting in the implementation of national programmes, for assessing problems and recommending government actions, and for on-going co-ordination with other interest groups.

The Task Force is particularly concerned that those involved in strategic planning for computer/communications should not find themselves having to deal with urgent day-to-day problems. In addition, long-range planning for computer/communications must be placed in proper perspective with regard to telecommunications and integrated with the strategic planning for total telecommunications. It is envisaged that strategic planning would be primarily an advisory function.

Program co-ordination, on the other hand, would be concerned with day-to-day problems, and would focus attention on computer/communications aspects of the wide range of actions and policies of different departments and agencies, in an attempt to rationalize existing fragmentation of responsibility.

Strategic Planning

The orderly development of computer/communications systems in Canada is dependent upon realistic long-range plans, based on needs and capabilities, taking into account existing conditions, trends, and potential problems as identified through a continual monitoring process. The need for future-oriented, multi-disciplinary planning is now receiving wide recognition and increased emphasis in many government and industrial activities.

The functions of this group may be summarized as follows:

- To identify user-needs and problems.
- To evaluate the impact on society of planned and projected computer/communications systems.
- To develop and recommend national policies and objectives, and recommend appropriate legislation.
- To foster and assist the development of a coherent data communications network in Canada.
- To recommend priorities for implementation of special systems.
- To recommend areas requiring special attention in research and education.
- To prepare technological forecasts.

A small, highly-qualified staff should be recruited from a number of appropriate sociological and technological disciplines. Provision should also be made for a number of visiting specialists for limited periods, and extensive use should be made of contracts with universities and other research institutions and associations. These arrangements would ensure that, while the strategic planning group is buffered from immediate problems, it would maintain contact with the problems of the day and be primed with fresh thinking and new ideas.

Program Co-ordination

In view of the unsettled and rapidly-changing situation in computer/communications, a unified approach could be taken by assigning responsibility for co-ordinating all current aspects of computer/communications to a single group. The function of the group would embrace all those activities specifically related to computer/communications which involve interaction with other federal government departments, with private industry and associations, and with provincial and international organizations.

The present fragmentation in the government's approach to issues and problems in computer/communications would be overcome most readily by maintaining a group to focus its attention on such issues. The Task Force has identified a number of problem areas, which indicate the magnitude of the task. Additional specific problems within these areas have been brought to its attention through representations to the Minister of Communications, or through direct representations to the Task Force. These have occurred with sufficient regularity during the life-time of the Task Force to emphasize the continuing requirement for dealing coherently with day-to-day questions.

The functions of the program co-ordination group may be described as follows:

- To work closely with provincial authorities and those of other federal government departments and agencies in helping to resolve common problems, and identifying common needs related to computer/communications.
- To assist in the implementation of pilot-projects carried out in conjunction with provincial authorities, private industry, and other federal departments.
- To work closely with carrier organizations and standard-setting bodies in the development of technical standards for the network and for interconnection.
- To co-ordinate standards-setting activities of Government departments and agencies, and to work closely with industry, in the standard-developing process.
- To ensure that developments of computer/communications systems comply with long-range plans for the evolution of a coherent data communication network.
- To ensure that the Canadian position is maintained in international activities, and in agreements made between Canadian and foreign carriers.
- To monitor activities of organizations providing data processing services and data communication services in order to detect the development of trends that may be contrary to the public interest.
- To assess the feasibility of achieving rates which are largely independent of distance for data communications related to special services.

By relating recommendations to the responsibilities of the strategic planning group and the program co-ordination group it becomes apparent that there is a clear distinction between their functions. Some recommendations affect both groups, but in all these cases the strategic planning function is related to establishing and recommending principles, plans and priorities; it falls to the program co-ordination group to foster implementation.

The functions of the Focal Point as envisaged by the Task Force in co-ordinating, promoting, and recommending national policies for computer/communications, and in assisting Canadian telecommunication systems to adjust to the changing requirements imposed by computers, are closely related to the definition of duties outlined in sections 4 and 5 of the Department of Communications Act (RSC 1970, c.C-24), *viz*:

> "4. The duties, powers and functions of the Minister of Communications extend to and include all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, branch or agency of the Government of Canada, relating to
>
> a) telecommunications; and
>
> b) the development and utilization generally of communication undertakings, facilities, systems and services for Canada.

"5. (1) The Minister of Communications, in exercising his powers and carrying out his duties and functions under section 4, shall

(a) Coordinate, promote and recommend national policies and programmes with respect to communication services for Canada, including the Canada Post Office.

(b) promote the establishment, development and efficiency of communication systems and facilities for Canada;

(c) assist Canadian communication systems and facilities to adjust to changing domestic and international conditions;

(d) plan and coordinate telecommunication services for departments, branches and agencies of the Government of Canada;

(e) compile and keep up to date detailed information in respect of communication systems and facilities and of trends and developments in Canada and abroad relating to communication matters; and

(f) take such action as may be necessary to secure, by international regulation or otherwise, the rights of Canada in communication matters.

(2) The Minister of Communications may, with the approval of the Governor in Council, enter into agreements with the government of any province or any agency thereof respecting the carrying out of programmes for which the Minister is responsible."

In the light of the close relationship between these duties and those outlined previously for the federal Focal Point in the area of federal responsibilities in computer/communications, the Task Force considers that the Minister of Communications and his Department should be the designated focal point for co-ordination in the development and continuing assessment of national policy for computer/communications.

2. FEDERAL-PROVINCIAL COLLABORATION

The importance of close collaboration between the federal and provincial governments in the successful implementation of national policies in computer/communications has been emphasized throughout this report. Collaboration is necessary in a number of areas including planning and policy formulation, compatible legislation, regulatory policies and procedures, and appropriate arrangements at the working level.

Development of communications in Canada has led to a complex mixture of federal and provincial Crown corporations and private companies, some of which are regulated by a federal body, and others by provincial bodies. It is possible for the federal government and for individual provincial governments

to take unilateral action in formulating and implementing policies and in developing and introducing computer/communications systems. There is, however, such close interdependence among the carriers and among the different governments in this field that independent actions by one government could have serious repercussions on the activities of others. Further, investments in money and manpower required for major public computer/communications systems are so great that individual governments will be hard-pressed to find sufficient resources for separate developments.

It will therefore be to the advantage of all governments to collaborate in resolving the many difficult and contentious problems posed by computer/communications.

Experience has shown that the introduction of computer methods and techniques into any large organization has necessitated significant changes in approach and in interrelations between various segments of that organization. It is perhaps trite to emphasize that this will be no less true in regard to the interrelationships between federal and provincial governments with regard to computer/communications.

In developing a unified approach to computer/communications for the orderly evolution of a data communications network in Canada, emphasis will need to be placed increasingly on multilateral planning and development. The co-ordination of policies and joint federal-provincial involvement in establishing priorities and in fostering the development of systems, will require discussion and consultation at the highest level. This will necessitate frequent consultations between the Minister of Communications and his counterparts in the provinces.

The initiative shown by the Maritime provinces in their plans for consolidating requirements and pooling resources in computer/communications provide an example of the need for ministerial consultations and an indication of possible measures that might be taken on a wider basis.

Coupled with the need for consultations at the ministerial level to foster a cohesive policy framework for computer/communications in Canada, there will be a need for increased consultations and joint developments at the official level. There is a need for a continuous interchange of views and information on all aspects of computer/communications, including user needs and problems, trends in the industry, and proposed government actions, as well as specific systems developments.

At the regulatory level, some co-ordination between the independent bodies is necessary to avoid the development of incompatible practices. The Task Force therefore suggests that a mechanism such as a Council of Regulatory Commissioners and Boards responsible for telecommunications should be considered.

This would provide a forum for discussion and possible resolution of some of the difficulties, would permit the identification of gaps in the areas covered, and would serve to promote the development of a cohesive approach to regulatory procedures for computer/communications throughout Canada.

3. RELATIONSHIPS BETWEEN GOVERNMENT AND INDUSTRY

Recommendation 2 calls for the closest possible co-operation between the public and private sectors in the development of national policies for computer/communications. Government actions recommended in this Report will bring the two sectors closer together in an interactive framework, rather than one in which prime emphasis is on regulation. However, regulation of certain aspects will continue to be an important area of government action.

At present the only direct regulation that relates to the computer/communications industry is that of the telecommunications carriers by the several federal and provincial regulatory agencies. Suggestions are therefore included in the following sections as to the new roles envisaged for these agencies with regard to computer/communications, together with suggestions for revisions to the legislation governing these agencies.

(a) The Role of the Telecommunications Regulatory Body

A number of Task Force recommendations suggest regulatory policies relating to such matters as carrier entry into data processing, use of customer-supplied attachments, interconnection, use of carrier lines and facilities, and network standards. In order to allow the appropriate regulatory body to adopt and implement these policies, with adequate jurisdiction to review and revise them should inadequacies or loopholes appear, the Task Force recommendations would require that the present legislation governing the federally-regulated telecommunications carriers should be amended where necessary to give specific jurisdiction to the appropriate regulatory body (at present, the Canadian Transport Commission) in regard to the following matters:

- The power to prescribe the conditions for entry by the carriers, or by partially or wholly-owned subsidiaries of the carriers, into non-regulated activities, including data processing. This might be part of a broader jurisdiction to review all non-regulated activities or investments by the carriers, the basis for such review being the effect of these activities both on the provision of traditional carrier service, and on the competitive structure of the non-regulated activity.
- The power to require the carriers to permit the use of foreign or customer-supplied attachments to the carrier facilities, subject to such technical or economic conditions as it may prescribe or arbitrate.
- The power to order interconnection between systems of data communications carriers, and between those of carriers and non-carriers, upon such conditions as it may prescribe.
- The power to arbitrate and remove or alter any specific or general restrictions on the use of carrier facilities set out in the carrier tariffs, where such restrictions have, in the opinion of the regulatory body, extended the area of carrier monopoly beyond that reasonably required for the discharge of the carrier's public obligations.
- The power to review and approve agreements respecting international tolls, charges, and tariffs arrived at between Canadian and foreign telecommunications carriers, and to prescribe by regulation the conditions for interconnection between such carriers.

In regard to each of the above matters, the Task Force has recommended administrative policies in earlier chapters. These policies are not meant to be embodied in statutory form, but would be the subject of detailed regulations passed by the regulatory body after due consideration at public hearings at which both industry and government views could be made known. If or when problems arise with regard to the day-to-day administration of the regulations, they can be amended by the body to take account of these problems. Accordingly, it is proposed that (a) the regulatory body be given a general regulatory or rule-making authority in regard to the above matters, enforceable by penalties or injunction; and (b) that all such rulings be subject to disallowance by the Governor in Council in cases where such rulings conflict with developing national policies in other fields (*e.g.*, regional incentive programmes, foreign ownership policy).

As part of the statutory framework for the regulatory body, a general statement of regulatory philosophy should be added to the appropriate legislation, which takes into account the needs of the competitive environment suggested in this Report, as well as the protection of the traditional carrier monopoly services. This statement of regulatory philosophy should be based on the concepts developed in earlier chapters of this Report.

(b) The Role of a Registrar of National Computer/Communications Networks

Recommendation 23 calls for the registration of organizations offering data processing services commercially through communications facilities with terminals on remote premises. The Task Force suggests the establishment of a Registrar of National Computer/Communications Networks within the framework of the federal regulatory commission. The Registrar would have no discretionary powers to refuse registration of any organization which provided the necessary information. The information required would be set in regulations approved by the Minister of Communications.

At the federal level, registration would be required for all suppliers of data processing and data bank services using data networks designed for communication with computers, where such networks have regularly-used terminals in more than one province, where such networks extend on a regular basis into foreign countries, or where such networks use, as an integral part of their operations, carrier facilities declared to be for the general advantage of Canada. The information sought would be kept to the minimum necessary for planning purposes, and might include a basic description of the network configuration, the technical specifications, the applicable tariffs, the nature and purpose of the computers linked to the network, the type of data stored in the computer, the type of traffic flow pattern, the nature of the application services and customer uses of the system and ownership of the network. Such information would be used for continuing surveys, evaluations of interconnection feasibility, and review of the development of the industry with a view to monitoring user needs that are still unmet and, the extent of the use of foreign data banks and computers by Canadians and *vice versa*, in case legislative or administrative policy changes are called for.

To facilitate these studies, the information collected by the Registrar would be available to the Focal Point. Some of the information, which might be detrimental to competition if disclosed, would not be open for examination by the general public. On a regular basis, the Registrar would summarize the trends and developments indicated by the registration process in reports to the industry. He would also seek to co-ordinate such information with any similar data collected by provincial registrars of data banks and networks, if such were established. New legislation should be introduced (perhaps as an extension of existing statutes relating to telecommunications) requiring the operators of national computer/communications networks to register with the appropriate federal official. Failure to register would be subject to punitive sanctions. Registration would be optional for all operators of "local" computer networks and operators of service bureaux where no remote facilities are used. Failure to register would not in these cases be subject to punitive sanctions, although such registration might be deemed a prerequisite for the obtaining of federal government grants or contracts.

(c) The Role of a Competitive Practices Tribunal

The Task Force anticipates that the introduction of new competition legislation covering services will assist in the achievement of the goals sought in this Report. Consequently, a need is seen for a Competitive Practices Tribunal with effective powers to review anti-competitive practices. The practices which would be subject to review include price discrimination, tied sales, directed selling, exclusive dealing, delivered pricing, and refusal to deal. Moreover, the recommendations in this Report with respect to free entry into the data processing services industry are all conditional on a competitive environment being maintained by such a Competitive Practices Tribunal. It would also review the practices of the telecommunications carriers, to the extent that their tariffs and practices were not subject to specific review by the regulatory agencies.

In addition, as mentioned in Recommendation 8, the entry of the banks into the data processing services industry may pose a unique problem. Accordingly, the Task Force considers that the Bank Act should be amended to provide that no chartered banks may offer data processing services to the general public in Canada, except where such services are directly incidental to the business of banking. A mechanism should be set up under the Bank Act through which interested persons may obtain rulings from the Inspector General of Banks as to whether any particular service offering is within or outside the meaning of "the business of banking", and the Act should provide that the banks would be bound by such rulings.

(d) A Computer/Communications Industry Planning Board

Recommendation 2 calls for close government-industry co-operation in the development of computer/communications in Canada. Avenues already exist whereby business and industry can make views known to government through representations to appropriate Ministers, Members of Parliament, and through direct contact with officers of government departments. The fact remains, however, that industry is not satisfied with present arrangements.

Accordingly, the Task Force sees a need for establishing a more formal approach whereby the private sector is not left to react to government actions, but is invited to participate in early discussions and can itself make constructive suggestions and proposals.

The Canadian Radio Technical Planning Board (CRTPB) was established in 1944 for giving advice and making recommendations to the government on the development and regulation of radio services in Canada, and is primarily concerned with standards and specifications relating to such services. Recently, its activities have been expanded to include broader responsibilities in the area of policy development. This arrangement appears to have worked well, and it is suggested that a similar approach might be taken with regard to the problems associated with computer/communications. The Task Force therefore sees a need for the establishment of a Computer/Communications Industry Planning Board, consisting of representatives from user and supplier associations, to assist in the development of national policies. Its objectives could encompass:

- Identifying problems and issues arising in computer/communications;
- presenting the views of different segments of the industry with regard to possible government policies and actions in the computer/communications field;
- initiating studies and investigations on matters of concern to the industry;
- promoting closer government-industry co-operation in resolving problems in computer/communications;
- promoting improved collaboration between different segments of the computer/communications industry;
- advising the government on specific problems referred to it for opinion;
- establishing specialized technical and other committees as required;
- collaborating in preparing national and regional forecasts and projections.

These suggested terms of reference give the proposed Planning Board a broad mandate within which to operate, but they should be further discussed and clarified during early meetings of the Board when it is established.

It is envisaged that the Board would be organized entirely by the private sector and would be representative of existing business and industry associations which have an interest in computer/communications. In order to initiate its formation, it is suggested that the Minister of Communications promote its inception as soon as possible and contact such associations with a view to setting up an inaugural meeting. Further action would then be left to the associations.

The government may be expected to provide financial support, particularly for the involvement of smaller organizations, but it should be left to the Board to forward specific recommendations.

The Board would meet as frequently as it felt was necessary. In general, these meetings would not involve government representation, except by invitation.

However, an annual joint meeting between the Board and representatives of government should be held under the aegis of the Focal Point. This annual meeting would provide a forum for detailed discussion of a wide range of problems. It would not preclude other meetings with departmental officials as the need arose.

The establishment of a Computer/Communications Industry Planning Board will help towards creating an environment for closer government-industry collaboration in facing the challenges posed by computer/communications. There is an additional need to place particular emphasis on the development of a co-ordinated data communications network in Canada. The Task Force therefore envisages the establishment of a Data Communications Advisory Committee as one of the permanent standing committees of the Planning Board. Such a committee is necessary in order to consider in more detail the requirements for development of a data communications network. Recommendation 19 places much responsibility for this development on the existing common carriers in Canada. The formation in February 1972 of the Canadian Telecommunications Carriers Association (CTCA) provides a formal means for carriers in Canada to consider problems and priorities, and to formulate cohesive plans for network development, including a consideration of specifications and standards.

Another permanent committee might be a Data Processing Advisory Committee which would also provide expertise and inputs to standards-setting organizations, particularly the CSA.

(e) The Role of the Canadian Standards Association

The need for increased attention to standards has been expressed in earlier sections. The Task Force has reviewed the various institutions involved in standardization activities in Canada. Whereas none has at present either the technical or the institutional scope that will be required for developing computer/communications standards, the Canadian Standards Association (CSA) does have the requisite basic background in the standards-setting process at the national level and therefore has a great advantage over any new organization which might be called into being. The Task Force therefore considers that, despite the expansion in scope of activities in the CSA which will be required, that body could be the most suitable to provide the carefully balanced and controlled environment for the preparation, adoption, and publication of computer/communications standards.

The CSA is active in the field of computer industry standards through its Sectional Committee on Computers, Information Processing and Office Machines. This Committee deals with the range of standards from programming languages to keyboard layout. However, communication networks standards and specifications have been developed by the common carriers and their supply industry. With the proposed increased participation of these organizations in the activities of CSA, it is expected that communications networks standards and specifications will be made available to CSA on a continuing basis. The task for the CSA will be to co-ordinate and prepare

standards that will maximize the efficiency and flexibility of technical interfaces between computers and data communications and minimize problems due to technical incompatibilities.

An additional role for CSA in computer/communications would be the examination and certification of computer/communications equipment. This is made particularly important by Recommendations 12 and 13 which permit a more liberal approach to attachment of equipment to the carrier networks. The CSA is already engaged in similar activities for certifying electrical apparatus for safety standards. It is proposed that the CSA be encouraged to establish the necessary organization and plant.

In its implementation of equipment certification there are several options to consider, but first it is necessary to recognize that the expense involved is not an obligation of the carriers unless it is their own equipment which is being certified. The CSA might choose to build its own facility; sub-contract to consulting organizations, or even engage the services of the carriers in certain cases. The Task Force is of the opinion that it will be necessary to keep the operation independent from vested interests and that, whatever option is selected, it will be necessary for CSA to retain the responsibility for certification.

The CSA would continue to be an industry organization and would derive principal membership and financial support from that source, although in the initial phases of its expanding role, government funds may be necessary.

The following figures and explanatory notes summarize the suggestions made in this chapter.

4 A CHART GUIDE TO THE INSTITUTIONAL RELATIONSHIPS

NOTES TO FIGURE 11 -

• *The Role of an Interdepartmental Committee on National Computer/ Communications Policy*

As indicated in Figure 11, a number of federal departments at present have substantial impact on national computer/communications policy. This impact ranges from the preparation and implementation of statutes affecting the industry (*e.g.*, the Income Tax Act, the Patents Act, the Combines Investigation Act, the Bank Act) to administrative policies relating to development funding, research, regional incentives, procurement, and similar matters. In order to co-ordinate these policies for the benefit of Canadian industry and Canadian computer/communication users, it is suggested that an interdepartmental committee be created which would include among its tasks the co-ordination of national policies relating to computer/communications. It is possible that in order to avoid a proliferation of such committees the mandate of the interdepartmental committee could extend also to other related areas. The intent of the creation of this committee is to provide a forum to facilitate the interchange of information and for the co-ordination of departmental policies.

• *Role of a Focal Point*

The Task Force recommends (Rec. 4) that within the federal government a Focal Point be created for co-ordination in the development, formulation and continuing evaluation of national policy in all matters pertaining to the field of computer/communications. The functions of the Focal Point fall into two broad categories; (a) strategic planning; for the identification of user needs, for the preparatory work on, and review of, national policies and objectives, and for the evaluation of impacts on society; and (b) programme co-ordination; for assisting in the implementation of national programmes; for assessing problems and recommending government actions; and for ongoing co-ordination with other interest groups.

The specific role of the Focal Point in relation to the computer/ communications industry is discussed in detail in Note 1 to Figure 13. The Focal Point would also provide input to the Interdepartmental Committee on National Computer/Communications Policy. This input would particularly relate to the various external proposals, decisions, or legislation affecting the computer/communications field. A further possibility which would facilitate co-ordination would be for the Focal Point to act as a secretariat to the Interdepartmental Committee, in order to assist in the assimilation of the various inputs from the departments concerned with computer/communications policy.

Figure 11
Suggested Institutional Arrangements
at the Federal Departmental Level

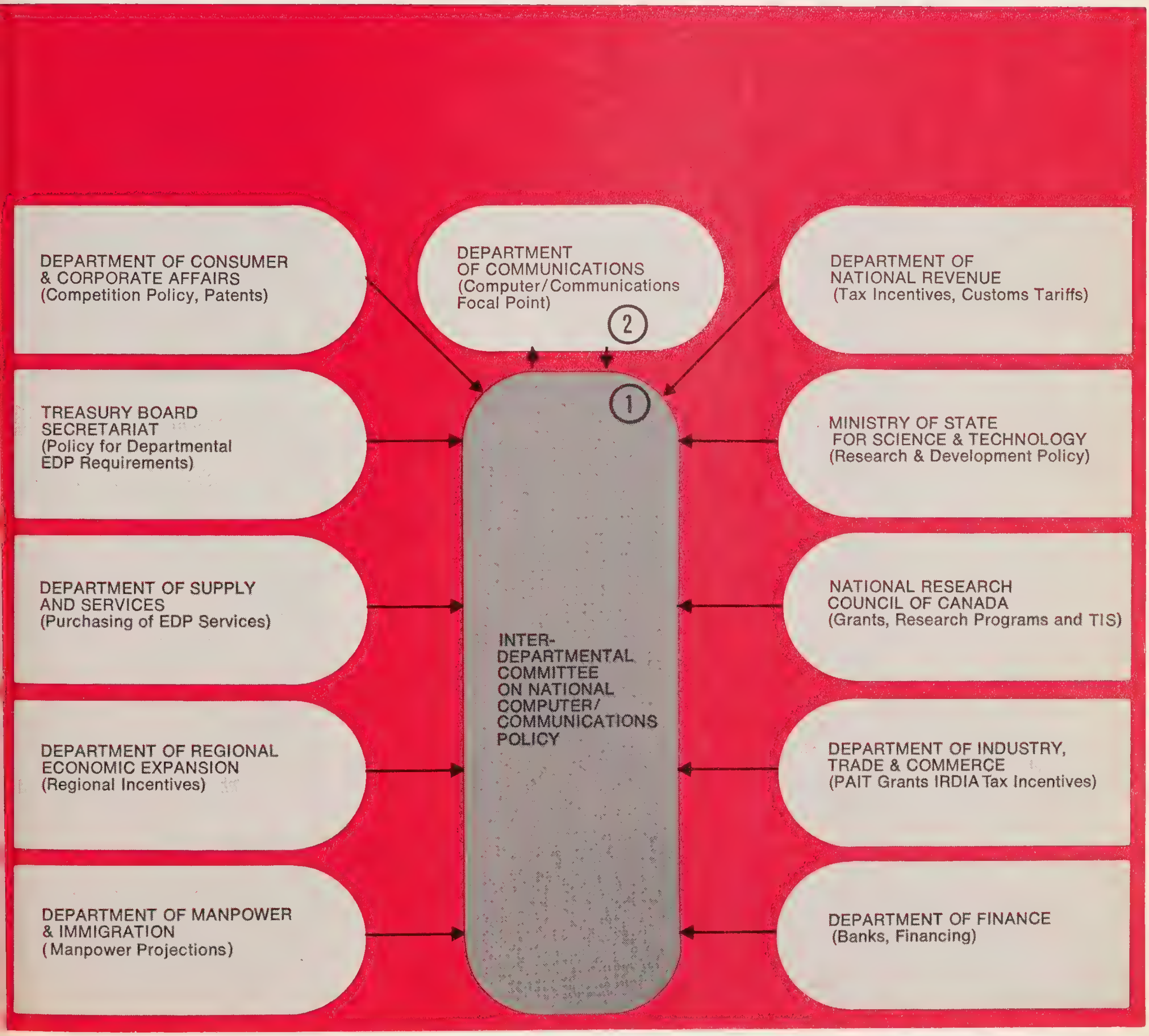
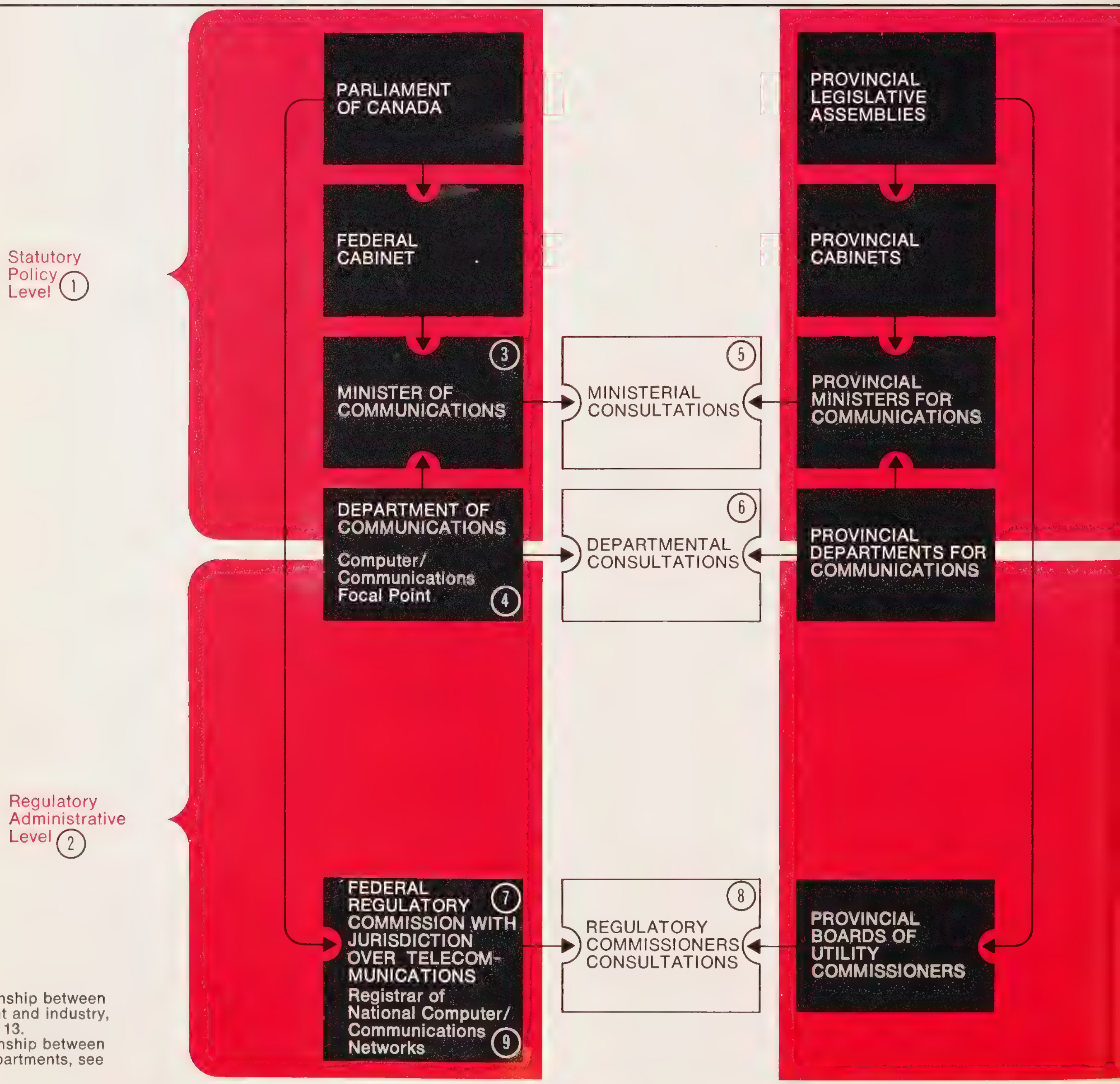


Figure 12
Suggested Federal-Provincial Liaison
for Computer/Communications Policy



For relationship between government and industry, see Figure 13.
For relationship between federal departments, see Figure 11.

NOTES TO FIGURE 12

• *Ministerial Involvement at the Statutory Policy Level*

A distinction is drawn between the appropriate role for executive involvement in computer/communications policy and the involvement of the regulatory bodies, a distinction which is also found in such areas as broadcasting policy. The ministerial role is that of suggesting and implementing broad statutory policies relating to the fundamental long-range structure of the industry. In computer/communications, this would involve fundamental policy, development of appropriate legislation, and decisions on such matters as whether sectors should be regulated or unregulated, and the appropriate role for the regulatory body.

• *The Conceptual Role of the Regulatory Commissions*

It is not envisaged that there should be any direct regulation of the computer/communications industry as such. To the extent that regulation is required on such matters as network interface standards, the relationship between the monopoly and competitive services of the telecommunications carriers, and complaints about tariffs and practices, the appropriate regulatory commission would conduct hearings and render decisions. The jurisdiction of the boards or commissions to deal with these matters would be set out in their enabling statutes (perhaps supplemented by statutory provision for ministerial directions on specified matters) as enacted by the appropriate legislature.

• *The Role of the Federal Minister of Communications*

Although the federal Minister of Communications has a variety of other responsibilities in regard to communications under several federal statutes, only those functions relating to computer/communications are reflected here. The Minister and his Department, as the Computer/Communications Focal Point, would be responsible for evaluating and recommending broad statutory policies for computer/communications insofar as they fall within the legislative authority of Parliament.

• *The Federal Department of Communications*

In order to provide a resource centre for the development and evaluation of computer/communications policies, it is proposed that the Minister of Communications and his Department be designated as the Focal Point for matters falling under federal jurisdiction.

• *Liaison Between Ministers Responsible for Communications*

Liaison between federal and provincial ministers is desirable for the formulation and development of cohesive computer/communications policies in Canada. The Task Force recommendations are particularly directed towards a cohesive policy, suggesting consultations at the ministerial level.

• *Liaison Between Departments Responsible for Communications*

Continuous liaison and consultation between departmental officials for the exchange of information and the consideration of possible joint developments are desirable. In support of these, there should be an interchange of relevant studies, forecasts, and accumulated statistical data on computer/communications.

• *The Federal Regulatory Commission*

The role of the federal regulatory commission with jurisdiction over telecommunications is described in Figure 13, Note 2.

• *Liaison Between the Federal and Provincial Regulatory Commissions and Boards*

Just as liaison is desirable between federal and provincial governments involved with computer/communications policy, it is also suggested that continuing liaison be developed by the Federal Regulatory Commission with provincial boards and commissions dealing with the regulation of the telecommunication carriers. In computer/communications, this liaison would facilitate the ability of the boards to develop compatible administrative practices, particularly in areas where the carriers under their respective jurisdictions interact directly with each other. Because of the impact of practices relating to the federally regulated carriers on practices elsewhere in the carrier industry, it is suggested that broad new administrative practices to be implemented by the federal regulatory commission be referred to the provincial boards of utility commissioners for comments and discussion. This would not apply to particular day-to-day administrative decisions, but rather to more fundamental rule-making actions of broader scope.

In developing regulatory practices for communications in Canada as they may affect computer/communications, it will be desirable for the several regulatory commissions and boards to exchange views on many areas such as: broad regulatory and administrative practices proposed for implementation in the computer/communications areas; research studies on the forms of existing and contemplated administrative policies and practices; and probably specific rulings on matters of general interest such as foreign attachments. The consultations and exchanges of information could be formalized by creation of a Council of Regulatory Commissioners.

• *Registration of National Computer/Communications Networks*

The Registrar of National Computer/Communications Networks would be an officer responsible for the registration of suppliers of commercially offered data bank and data processing services through computer/communications networks where these have federal attributes. It is suggested that he be an official reporting to the federal regulatory commission with jurisdiction over telecommunications. The purpose of this registration process and its relationship with provincial concerns is discussed in more detail in Figure 13, notes 6,7 and 8.

NOTES TO FIGURE 13

• *Focal Point and Industry*

An exchange of views, information and policy proposals between industry and government is desirable. It is recommended that the Focal Point maintain close liaison with the computer/communications industry. Furthermore, it is proposed that representatives of the Focal Point should participate in joint committees set up under an industry planning board, (Note 9) and especially in CSA committee activity (Note 10). The Focal Point would also be responsible for funds to be granted in special circumstances, for example to support CSA expansion.

• *Role of the Federal Regulatory Commission*

The role of the federal regulatory commission with jurisdiction over telecommunications would be expanded to embrace a variety of computer/communications aspects of carrier operation not now reviewed by the Canadian Transport Commission. In particular it would be given expanded jurisdiction with respect to intercorporate activities and the conditions for entry of carriers into the provision of commercial data processing services; foreign attachments and the arbitration of the technical and economic criteria for their use; and the power to order interconnection between data communication networks, upon such conditions as it may order. In addition, it is suggested that the federal regulatory commission for telecommunications should put strong emphasis on cost allocation studies and the evaluation of route and service pricing for data communication services.

• *The Role of Provincial Boards*

At present there are nine active provincial boards of utility commissioners which regulate the public telephone service of a number of companies operating within their respective provinces. The policies and jurisdiction of such boards are outside the purview of this Report.

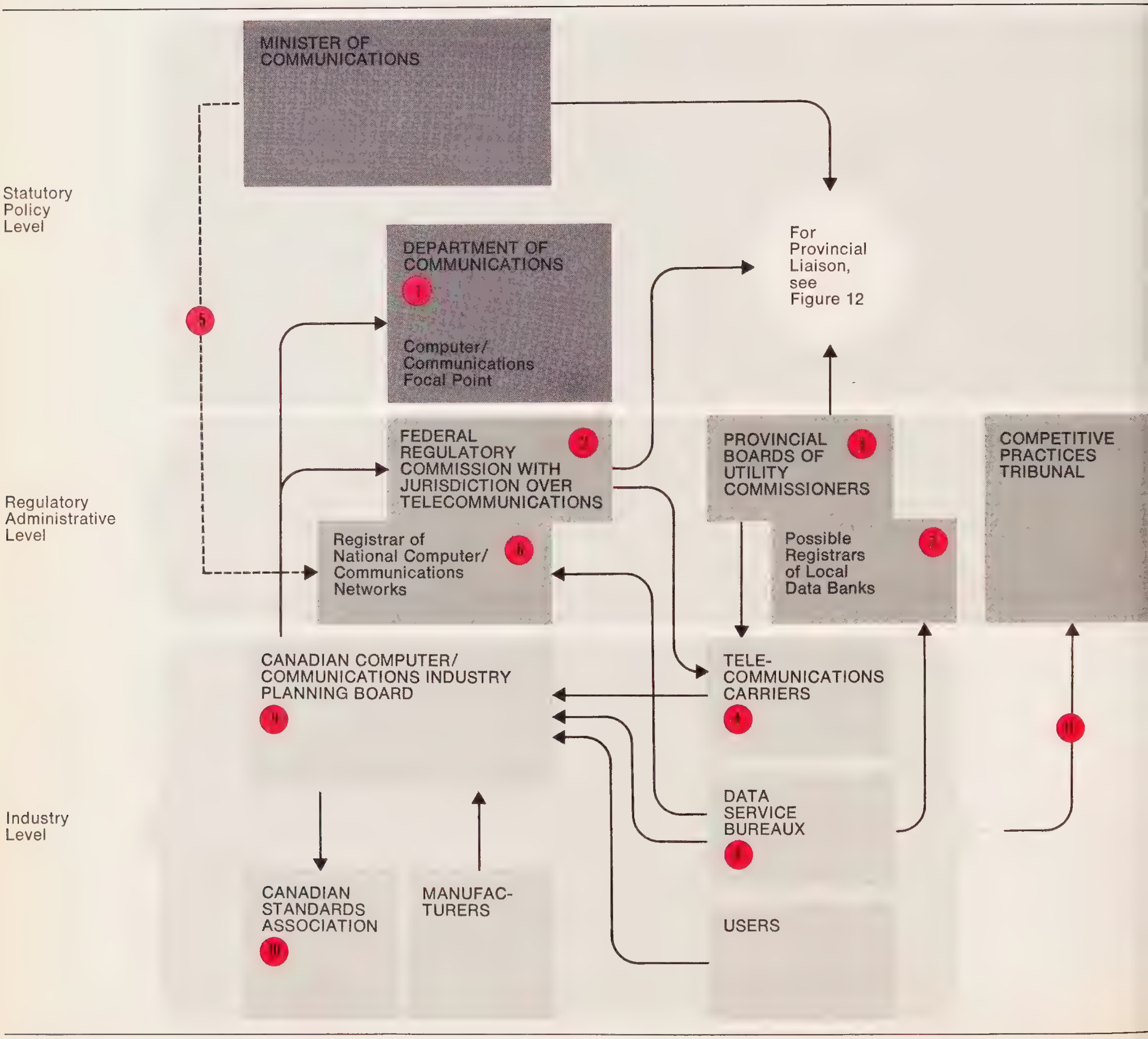
• *Regulation Confined to the Telecommunications Carriers*

The computer/communications industry is made up of a number of sectors, all of which overlap to a certain extent. This Report contemplates that there be no regulation of computer/communications as such, except with respect to the telecommunications services provided by the telecommunications carriers. This is indicated in Figure 13 by the arrows pointing from the boards and commissions to the telecommunications carriers. No such arrows point to any other segments of the industry.

• *Ministerial Regulations on Registration Requirements*

The Task Force Rec. 23 requires the establishment of a Registrar of National Computer/Communications Networks, discussed further in Note 6 below. The information to be collected by him would be defined by the Minister of Communications.

Figure 13
Suggested Government-Industry Relationship
for Computer/Communications



• *Nature and Function of the Federal Registration Process*

The Registrar of National Computer/Communications Networks would be an administrative officer of the federal regulatory commission. This officer would be responsible for the registration of organizations offering data bank and data processing services through computer/communications networks where these have federal attributes. The purpose of the registration process is solely one of information and the Registrar would have no discretion to refuse registration if the required information is provided.

• *Possible Role of Provincial Registrars*

Clearly, not all data networks will be covered by the federal registration process; moreover, many services are still used only on an over-the-counter basis. With regard to such matters as privacy, ethical standards, financial responsibility, and liability for damage, the provinces may wish to set up a similar registration process relating to local data banks and networks. Alternatively, a province may wish to delegate the registration of local data banks and networks to the federal Registrar in return for complete reports on all information collected for the province.

• *Provision of Information by Service Bureaux*

No direct regulation of service bureaux is envisaged, except that they may be required to register with the federal Registrar if they make their service available through remote links under circumstances giving rise to federal jurisdiction.

• *The Role of an Industry Planning Board*

The many voices of the computer/communications industry should be collectively expressed to government, both on policy and regulatory matters pertaining to computer/communications. Present relationships are on an *ad hoc* basis which could become more effective through the establishment of a Canadian Computer/Communications Industry Planning Board (CCCIPB). This Board, composed of associations of users, manufacturers, data service bureaux, and the telecommunication carriers, would have the primary role of facilitating liaison between industry and the government, particularly with regard to proposals for and comment on computer/communications policy. It is not intended that the CCCIPB should demand a consensus from its members, but that it should act like the Canadian Radio Technical Planning Board with its impact on government policy for frequency spectrum and radio services. Two major sub-committees of the CCCIPB would be a Data Communications Advisory Committee and a Data Processing Advisory Committee, both of which would, in addition to their social and economic policy interests, provide technical expertise and inputs to the Canadian Standards Association. Also, the Data Communication Advisory Committee, which might largely consist of members of the newly-formed Canadian Telecommunications Carriers Association, could meet regularly with the Focal Point to formulate guide-lines which the carriers could follow in developing the necessary data communications services and network architecture.

• *Enlarged Role for the Canadian Standards Association*

The Canadian Standards Association is an industry-sponsored standards-setting and testing organization having the background and organization which could be augmented to provide the capability for comprehensive development of computer/communications standards for Canada. The Task Force proposes that the CSA be concerned with data communications standards. The primary task would be to co-ordinate and implement standards that will maximize the effectiveness of technical interfaces between computers and data communications. It is further proposed that the CSA be encouraged (with federal assistance, if desired) to undertake the necessary expansion of personnel and facilities to enable the testing and certifying of data communications equipment. The participants in the standards-setting process would be the various interested representatives of industry together with the Focal Point in the Department of Communications. The intent is that the industry, through CSA, should establish voluntary standards which may receive government sanction as may be justified by national and international public interest.

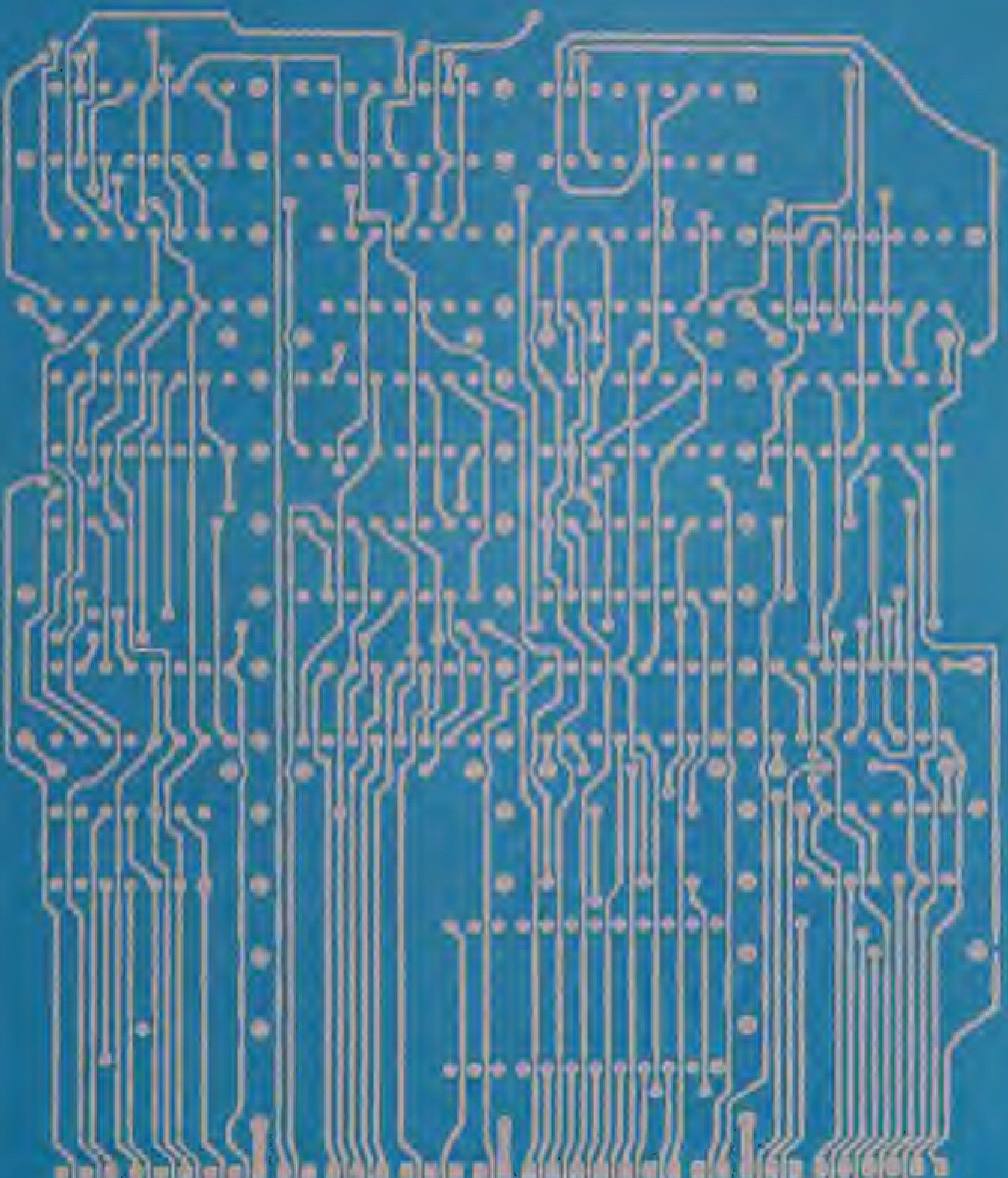
• *The Role of a Competitive Practices Tribunal*

Under both the present and proposed general legislation relating to competition policy in Canada, exemptions to the legislation are given for anti-competitive practices that are specifically subject to continuing review by a regulatory body in the public interest. Thus, to the extent that the computer/communications industry is regulated by regulatory boards or commissions, it is not subject to the general terms of the competition legislation. This Report suggests that the carriers in respect of their monopoly or duopoly services and practices be subject to direct regulation, and that the industry in most other respects be unregulated. Hence, the competition legislation may have significant impact on pricing and marketing practices adopted by such organizations as service bureaux, computer mainframe and peripheral manufacturers, and applications service suppliers. To the extent that tariffs or practices of the telecommunications carriers are not subject to specific review by the regulatory agencies, such practices will also be governed by the terms of the general legislation relating to competition policy. Since open and fair competition within the computer/communications industry is a central element in this Report, the Task Force considers the enactment of competition legislation attuned to the needs of the computer/ communications industry to be of great importance.

Part

F

In Conclusion



In his study, *An Institute for Research on Public Policy* (Information Canada, 1971), Ronald S. Ritchie has the following comments on the activities of task forces in general:

"The research efforts of Royal commissions and task forces suffer the defects of the situation which creates them. Almost always, the appointment of a Royal commission or task force is an *ad hoc* response to a situation which is already urgent, if not critical. The whole research process is, therefore, under stringent, perhaps unreasonable, time pressures. The members of the commission or task force are likely to be under pressure from the government, from opposition politicians, or from the public at large to produce recommendations in the minimum possible time. They may be tempted to arrive at conclusions before all the research evidence is in or, in any event, before there has been time for adequate objective identification and evaluation of major policy alternatives. For proper policy research results to be achieved, it is almost always evident that the research should have been undertaken much earlier and in circumstances where the pressure for policy answers was less acute."

It would not be difficult to show that most of these problems have indeed been encountered by the Task Force on Computer/Communications. However, this describes only one aspect of the situation. The other is that of the rapidly-changing environment to which the Task Force addressed its efforts, as evidenced first by the rate of technological advance, and second by the progressing adaptation of industry, business and society to the new potentiality of computer/communications. Even within the short existence of the Task Force, many new types of enterprises have emerged, others have disappeared or changed purpose and structure; the carrier industry has unveiled plans for its response to the demands of the computer age, and has taken measures towards internal consolidation; the technology of mini-computers has shown the beginnings of an almost explosive growth; some provinces have declared their intentions in the area of telecommunications, and have made corresponding institutional arrangements; the federal government has developed policies for a rationalization and consolidation of its own data processing activities. The list could be much further extended — and it has not even touched on the changes taking place outside Canada, particularly in the United States. There is hardly an issue on the programme of the Task Force where the results of prior research were not at least partially affected or even superseded by events, or where the Task Force did not have to adapt its thinking to changing conditions. In such circumstances it is pointless to claim there has not been enough time, or that there were not enough opportunities for research. The answer must not be sought in the never-ending plea for more time and research — a plea which is based on the assumption that the final aim must be the proclamation of "firm" policies.

The real solution lies in recognizing that policies should not be conceived of as being static, even within a relatively short stretch of time, but should be capable of response to the pace of change. To ensure that new developments and decisions continue to conform with the public interest, a framework should be provided within which policies and their interpretation can be continuously adjusted in a dynamic feedback process, involving governments at all levels, institutions, private industry, business and the general public.

The problems of policy development in an environment as highly dynamic as that of computer/communications become particularly clear when policies for allocation of government spending are considered. The Task Force was directed to examine computer/communications networks of broad social significance, such as health care, education, and finance. It was thought that a cost-benefit analysis of a number of possible networks of national scope would lead to an indication of the amounts of money that might be required from public funds for the implementation of such systems, once their political priority and benefit to society had been established.

A number of such systems were investigated, as documented in Volume II of this report. However, it became clear during these investigations that the application of computer/communications in broad functional areas, such as health care, education, and finance does not yet lend itself to a definition which would meet the main prerequisites of an overall systems cost-benefit analysis, namely:

- A clear and quantifiable statement of need;
- a clear and realistic concept of the institutional framework within which the systems could be implemented and to which the benefits would accrue;
- a realistic model expressing the operational characteristics in quantifiable terms.

Although in general, the potential power and effectiveness of computer/communications are unquestioned, the applications within each broad field are still highly fragmented, and the degree to which benefits may be related to costs varies widely between individual situations. For example, in the health field, hospital administration, diagnostic aid, training aid, automatic patient testing, to name but a few, have totally different economic and operational aspects in the use of computer methods. Thus, each broad field is split up into many different, but often overlapping, sub-functions, most of which have not yet reached the point where quantitative statements can be made about their cost-effectiveness.

The role of computers in many of those sub-functions is still at the stage of experimentation and adaptation, where operational practices and procedures as well as technological solutions undergo continuing change as practical experience grows. This process of adaptation, between individual operational functions and technological tools in the component parts of the total system, necessitates many changes in the structure of the overall model before it can reach a level of stability that permits a valid assessment of total costs and overall benefits.

This example illustrates the inherent difficulty of prediction in a self-adaptive, changing environment. Although there is no doubt that eventually a well-defined overall ''system'', will have emerged, containing a multitude of sub-systems and ready to be analyzed in retrospect, it is impossible to anticipate the characteristics of the total system with sufficient accuracy for a valid predictive analysis. For the planning of such systems, the only possibility is a

gradual approach, following an evolutionary process in which individual planning decisions are made on component elements within an overall conceptual framework.

Thus, the field of computer/communications is characterized by two main factors: rapid technological change, and a vigorous process of adaptation of public and private institutions to the use of computers and communications as a tool in coping with economic and social pressures. The Task Force has found throughout Canadian governments, business and industry a great awareness of the potential of computers in controlling the increasing costs of industrial, social and cultural programmes. It also found a high degree of technical competence, innovativeness and familiarity with the state-of-the-art.

However, because of the role of computers and communications as tools in an infinite variety of different operations, computer-related activities at present are fragmented, leaving costs at levels where the effectiveness is questioned on economic grounds. This inevitably increases the attractiveness of services from outside the country, where the size of operations has led to the availability of a greater variety of services at lower marginal costs.

In this situation, in order to maintain and strengthen the Canadian presence in the computer/communications field, the government could inject massive sums to support and develop particular systems of national scope, but would have to face the difficulties of prediction and planning in broad functional areas encompassing many sub-functions.

Instead of attempting to formulate a policy of firm decisions on the allocation of funds to particular aspects of computer/communications, the Task Force has come to the conclusion that a faster response to present problems and a greater confidence-level for obtaining beneficial results could be achieved by a flexible approach. Particular emphasis should be placed on the creation of a favourable climate in which Canadian systems and applications in the public and private sectors are given opportunities for developing freely and at a pace allowing for self-adaptation.

This represents a policy of stimulation, and regulation in the broadest sense, where government action helps to overcome circumstances that inhibit Canadian development of computer communications. It also formulates general guide-lines for constraints and limitations necessary to safeguard the public interest and to maintain the climate for innovation required to withstand domestic and international pressures.

Development and implementation of such a policy is predicated on the establishment of mechanisms for intimate co-operation between the federal and provincial governments, and between the public and private sectors. The pervasiveness of computer/communications throughout all segments of Canadian social and economic activities must be reflected in a corresponding pervasiveness of the realization of the common responsibility for using this technology to the benefit of our society.

LIST OF RECOMMENDATIONS

General

Rec. 1 Computer/communications (*i.e.*, computer services by remote-access through communication facilities), should be recognized by governments as a key area of industrial and social activity, and steps should be taken towards strengthening of the Canadian industry in this field, and co-ordination of its development to the benefit of Canadian society.

Rec. 2 The federal government should take specific measures, as outlined throughout this report, to promote a high degree of co-operation between public and private sectors in the development and execution of policies for computer/communications in Canada.

Rec. 3 In the formulation of national computer/communications policy a unified approach throughout Canada should be stressed as a key factor requiring close co-ordination between federal and provincial actions.

Rec. 4 In the area of federal responsibilities a Focal Point should be established within the government for co-ordination in the development, formulation and continuing evaluation of national policy in all matters pertaining to the field of computer/communications.

Data Processing Services

Rec. 5 No restrictions should be imposed on the entry of any organizations into the commercial data processing business, unless such entry would lead to anti-competitive practices, not remediable under the general laws relating to competition in Canada.

Rec. 6 Federal legislation should be introduced which might serve as a model for parallel provincial action, empowering the federal regulatory body responsible for the regulation of telecommunications carrier organizations to impose conditions on the entry of telecommunication carriers into the business of offering data processing services commercially.

In particular, the Task Force has concluded that for carriers under federal jurisdiction the following set of constraints should be imposed:

Rec. 7 Telecommunication carriers wishing to offer data processing services commercially in Canada may do so only under the following conditions:

(i) That such services be offered by a separate affiliate, with officers, staff, equipment and computer facilities distinct from those of the carrier;

(ii) that all communications or other services provided to the affiliate by the related carrier must be tariffed and made available on a non-discriminatory basis to any other customer;

(iii) that the carrier may obtain data processing services from outside sources (including its data processing affiliate) save for those communications-oriented computer services which, in the opinion of the regulatory body, are integral to the operation of the public switched network; computer services, such as network switching, which are directly integral to the operation of the network should be provided by carrier in-house facilities designed exclusively for the public service obligations of the carrier;

(iv) that the carrier may purchase data processing services from its data processing affiliate, but that if it chooses to do so, it must carefully separate and identify such services, and file information as to their precise nature and cost for public inspection by the regulatory body; such costs and all transfer payments from the carrier to its affiliate or *vice versa* would be subject to regulatory scrutiny and review;

(v) that except for the restriction in paragraph (iv) above, all data processing services offered by the affiliate would be unregulated.

Rec. 8 Chartered banks should be permitted to offer data processing services to the general public in Canada, subject to the following conditions:

(i) that such service should be directly related to the business of banking; and,

(ii) that the Bank Act be amended to provide the mechanism whereby interested persons may obtain rulings, from the Inspector-General of Banks for the administration of the Act as to whether any particular service is within or outside the meaning of (i) above, and that the banks would be bound by such rulings.

Rec. 9 Universities, in the consideration of providing commercial data processing services to outside customers, should be strongly discouraged from taking advantage of their privileged position (which arises from their publicly-supported operating budgets, tax exemptions and grants), in areas where services are available from other sources. However, this policy should be sufficiently flexible to allow universities to employ excess capacity (over and above their primary teaching and research commitments) in special cases where commercial operations from outside sources are not filling the need.

Data Communications Services

Rec. 10 Policies in network development should be oriented in consultation and co-operation with the provinces and the private sector towards achieving rates for specific services in which the controlling factors may include time, bit rates or other parameters of network utilization but in which geographical distance is of minor or no influence, particularly within regional zones.

Rec. 11 Government should take steps through the Focal Point, in consultation and co-operation with the provinces, to ensure the evolution of data communications networks which in part are functionally separate from the telephone network, with the aim of having improved technical and economic service characteristics provided.

Rec. 12 A non-carrier organization leasing facilities from a carrier should be permitted to attach to those facilities any data communication equipment not owned by carriers, provided only that it meets published standards for continued protection of the carriers' networks from damage and interference; such an organization should, however, be encouraged to adopt published data network standards wherever possible.

Rec. 13 A non-carrier organization (including data processing affiliates of carriers) may offer commercial data communication services to customers through carrier facilities, subject to filing with the regulatory body prior to initiation of service, information on its corporate structure and its data communication services; and the regulatory body should be empowered to conduct hearings which may result in the services being disallowed on the grounds of failure to comply technically with published network specifications and standards, or of economic infringement of the common carriers' regulated public switched-network services.

Rec. 14 Carriers should be required by legislation to file with the appropriate telecommunications regulatory body, specifications and charges for data communication services; and the regulatory body should be empowered to approve such specifications and charges; and to require publication of them.

Rec. 15 The telecommunications regulatory body should be empowered to enforce adherence by the telecommunication carriers to prescribed procedures in the establishment of their data communication rates.

Rec. 16 Government, through the Focal Point, should request organizations offering data communication services to effect interconnections between their systems as needed for the development of a coherent data communication network.

Rec. 17 The telecommunications regulatory body should be empowered to conduct hearings and decide on cases involving interconnections between networks of carrier or non-carrier organizations offering data communication services.

Rec. 18 Decisions of the federal telecommunications regulatory body should be published and made readily available.

Rec. 19 The plans of the telegraph (railway) companies for the immediate development of their teletype and data services, and the projected plans of the telephone companies for the evolution of a data transmission network should be recognized by government as the present viable direction for the development of data communication facilities, and the government should, through the Focal Point, periodically take cognizance of these common carrier plans, and take steps to ensure the avoidance of disadvantages to users through incompatibilities in the communication services offered and to ensure that the carriers' long-term technical and financial planning is commensurate with the potential and the future requirements for computer/communications in Canada.

Rec. 20 Government, through the Focal Point, should intensify the establishment of a Canadian position on international issues in data communications and ensure appropriate representation on international bodies.

Rec. 21 Agreements between Canadian and foreign telecommunications carriers should be reviewed by the government on a regular basis to ensure that the Canadian position on international aspects of data communications is upheld.

Data Services Environment

Rec. 22 Policies in computer/communications development should be oriented, in consultation and co-operation with the provinces, towards improving service availability and reducing costs in Canada in order to offset economic and technical incentives for meeting user needs through facilities outside Canada.

Rec. 23 Organizations offering data services commercially to customers through telecommunications facilities, with terminals on remote premises, should be required to register with an appropriate body, and file information on their corporate structure, and on their data services.

Rec. 24 Governments should recognize the importance to the public interest, of a strong Canadian-controlled data processing services industry.

Rec. 25 Before computer-based information services are offered on a regular basis to individual Canadians and the public in general, governments should consider the feasibility of imposing special requirements on Canadian ownership and control of organizations providing services which convey cultural values analogous to those conveyed by broadcasting systems, and on the volume of material from Canadian sources made available through such services.

Government Actions Related to Stimulation of Development

Identification of Priorities

Rec. 26 The Focal Point should periodically, and in close co-operation with associations and industries, undertake identification of user needs and evaluation of the impact of existing and projected computer communication systems on society.

Rec. 27 Government should stimulate the advance of special computer/communications systems, particularly those having broad social benefits to Canadians, by making funds available through the Focal Point for pilot projects undertaken by or in conjunction with associations, industry, universities and governments at all levels.

Rec. 28 In government support of projects, priority should be given to those which involve the formation of regional and nation-wide computer systems in the public sector, designed to make available on a shared basis, computer and specialized data bank facilities to public institutions and to the general public.

Rec. 29 In conjunction with universities and other research institutions, government should foster multi-disciplinary research on the long-range social effects of computers and communications.

Rec. 30 Existing government research laboratories should include in their programmes selected areas of computer/communications technology and make the results available to public and private organizations for the development of techniques and applications specifically adapted to Canadian needs.

Government Support of Industry

Rec. 31 Government should continue its efforts to ensure that foreign or multi-national computer and communications corporations with substantial sales in Canada, expend appropriate sums in Canada on research and development leading to manufacturing activities.

Rec. 32 Incentives should be granted to Canadian enterprises for all phases of innovation in the computer/communications field, particularly in application software and ancillary equipment development.

Education and Training

Rec. 33 Government should support professional and industry associations in their endeavour to organize and stimulate the provision of suitable training programmes in the field of computer/communications in collaboration with educational institutions.

Rec. 34 Government should encourage post-secondary educational institutions to offer courses on the multi-disciplinary aspects of computers and communications systems.

Rec. 35 Government should encourage research and development into the use of computers at all levels of education through co-ordinated funding on a multi-disciplinary basis and extension of existing programmes in technological development.

Standardization

Rec. 36 The Focal Point should co-ordinate the participation of the federal government in national and international standardization activities relating to computer/communications, and, in conjunction with provincial governments, industry and user associations, promote the preparation, publication and adoption of standards for an orderly and coherent growth of computer/communications in Canada.

Rec. 37 Government should provide funds in order to increase the participation of user groups in the formulation of standards, and place increased emphasis on communications particularly in regard to interconnection of networks.

Government As a User

Rec. 38 Steps should be taken to ensure that the policies for internal federal government data processing and data communications activities are continually related to national policies in the computer/communications field.

Rec. 39 Federal government policies, for the procurement of computer and communications goods and services to satisfy the internal needs of departments, should be directed towards the greatest possible stimulation of the computer/communications industry in Canada.

Institutional Arrangements

Suggestions are presented in Part E in three areas of interactive relationships:

1. Relationships within the Federal Government

- Interdepartmental Committee on National Computer/Communications Policy
- Department of Communications as Focal Point for computer/communications

2. Federal-Provincial Relationships

- Ministerial Consultations
- Communications Regulatory Commissioners Consultations
- Departmental Consultations

3. Government-Industry Relationships

- The role of the Federal Telecommunications Regulatory Commission in matters of computer communications
- Registrar of National Computer/Communications Networks
- Canadian Computer/Communications Industry

APPENDIX 1

BACKGROUND AND PURPOSE OF THE TASK FORCE

In November 1970, the Cabinet authorized the formation of the Canadian Computer Communications Task Force (CCCTF) as a semi-autonomous body within the Department of Communications. The Minister of Communications accordingly announced that the chief task assigned to the group was to develop and recommend specific policies and institutions that would ensure the orderly, rational and efficient growth of combined computer/communications systems in the public interest.

The possible objectives of a national system, as stated in the press release of November 27, 1970 could include: "achieving the most rapid expansion of services and systems that is possible without unduly disturbing our ability to meet other urgent social priorities; ensuring the widest possible range of services to all social and regional groups in every part of Canada; ensuring adequate Canadian control and ownership; ensuring that the overall system design is flexible enough in concept and implementation to minimize problems of obsolescence and permit the rapid incorporation of improvements resulting from technological change; ensuring adequate protection for privacy, right of access and freedom of speech in all elements of the national system."

In the same press release, the Minister "stressed that the task force's objectives will require co-operation with industry, users and other governments. He outlined some of the steps in the task: an analysis of national needs; technological forecasting; a study of social and economic impact, and, a definition of possible institutional arrangements. The group will bring cost-benefit analysis to bear on particular networks that might be able to provide such services as legal, financial, medical and consumer information as well as raw computer power".

1. ORGANIZATION AND STAFFING

The organizational structure of the Task Force has been kept flexible to allow for changes in orientation as each phase of the work program was completed, and in order to focus talents and resources on the diversity of activities in the computer/communications field. The organization adopted is depicted in Fig. 14, which illustrates the interaction between the various areas of concern.

Staffing was a serious problem in view of the requirement for experienced, professional personnel willing to accept a 12 to 18 months' commitment without assurance of employment after that period. Interviews were arranged with more than 130 candidates and, as a result, it was possible to obtain commitments for a total of 25 man-years during the period 1 December, 1970 to 31 May, 1972. A list of personnel, and a chart showing the build-up of professional staff are shown in Fig. 15. All services have been negotiated either by secondment from government departments, or by personal contracts with individuals after they have separated from, or obtained unpaid leave of absence from their previous employers. Although industry

showed considerable interest in providing such personnel, no contracts were made with industry for the provision of staff in order to ensure the full objectivity of the Task Force.

2. WORK PROGRAM

The Task Force was engaged in a wide-ranging investigation of issues and problems in the computer/communications field in Canada. A firm of consultants was engaged to formulate a program management network chart whereby the various objectives could be related diagrammatically to each other in time and with respect to relative priorities. This chart made it possible for the Task Force to identify critical paths and allocate resources for maximum effectiveness. Fig. 16 gives a schematic description of the information-gathering phase of the work of the Task Force.

(a) Contact With Outside Organizations

From the very beginning, strong emphasis was placed on establishing a continuing interaction with a wide cross-section of institutions, organizations and individuals across Canada. To this end, and at an early stage, some 700 invitations for the submission of position papers were sent to major business and industrial enterprises, and contact was also established with provincial governments, as well as with federal government departments and Crown agencies.

Organizations in the private sector were divided into users of computer/communications, and suppliers of computer/communications goods and services. In the category of user organizations, over 400 letters were sent to business and industrial enterprises, trade associations, and professional societies. Approximately 300 letters were also sent to supplier organizations. The response was good, and a large number of organizations requested interviews. Group meetings were arranged in the form of seminars, with extensive question-and-answer periods. At two meetings in Toronto and one in Montreal, some 200 senior representatives from a wide variety of companies and organizations met and expressed their views. In addition, a series of speeches and seminars were organized across the country, in which Task Force members addressed various professional societies and associations.

A list of organizations submitting position papers is given at the end of this Appendix.

Good co-operation was received from departments and agencies of the federal government. A federal government Advisory Committee was formed and six meetings were held with the liaison officers appointed by the various departments and agencies. Thirty-five position papers were received through this committee.

With respect to provincial governments, delegates were nominated by the Provincial Prime Ministers and Premiers. After initial contacts had been established, a round of meetings in the provincial capitals took place, followed by two meetings to which all provincial delegates were invited.

Figure 14
Task Force Functional Organization

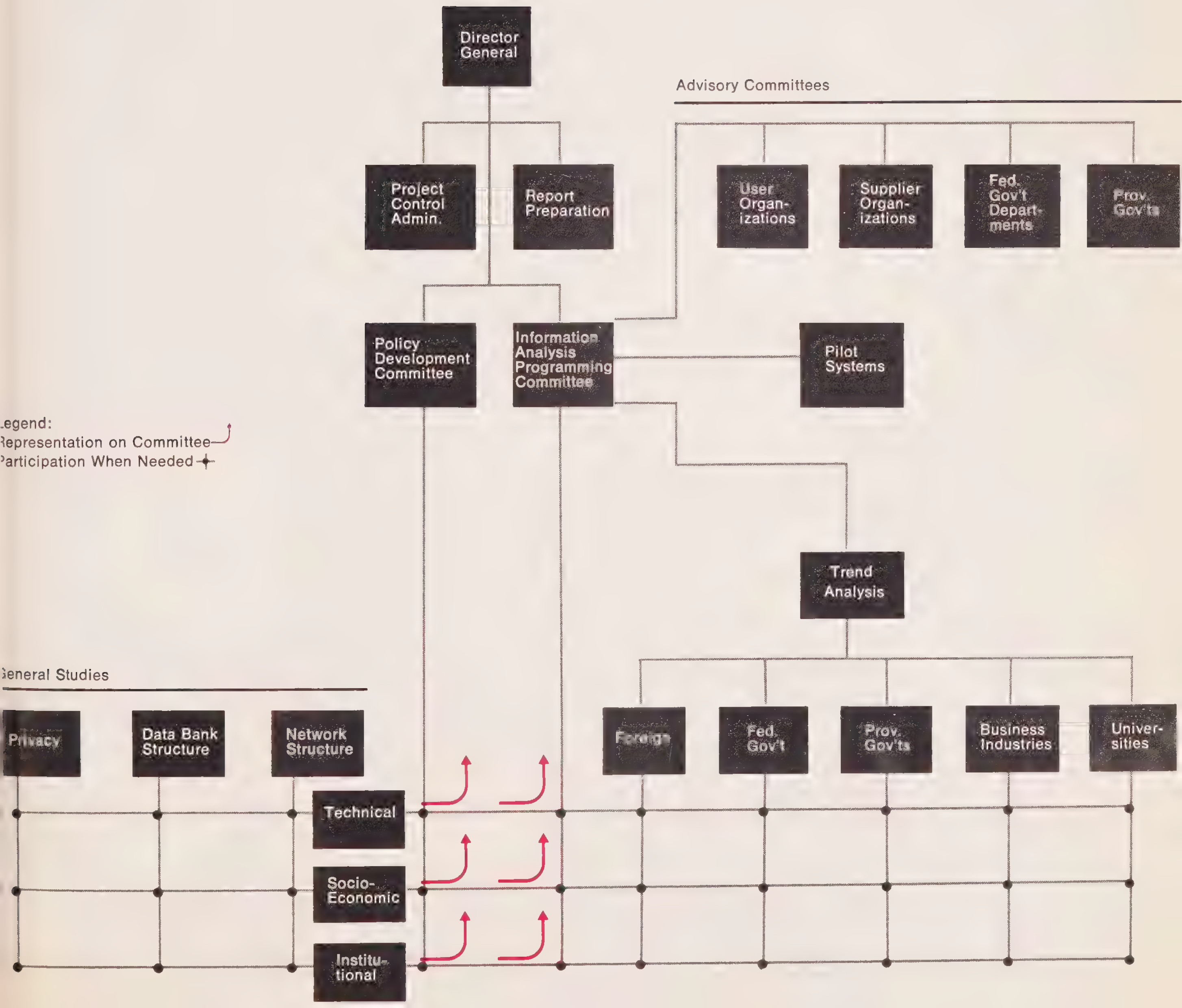


Figure 15
Professional Staff

Government

R. J. Bambrick (Govt. of N.B.)
E. R. Bushfield (DOC)
*J. A. Clement (DSS)
G. K. Davidson (DOC)
R. A. Eldred (MOT)
G. Fenton (TB)
*M. Gardner (DND)
*G. E. Henderson (DSS)
I. Jascolt (Agr.)
J. G. Nadon (PO)
R. O'Reilly (DOC)
P. Robinson (Agr.)
C. D. Shepard (DOC)
F. Tanguay (PCO)
R. van Eyk (DOC)
J. A. S. Walker (IT&C)
L. S. Zuckerman (PO)

Non-Government

A. S. Adams (AGT Data Systems)
H. H. Brune (Northern Electric)
**R. J. Campbell (RCA)
**T. A. Croil (Croil & Associates)
F. Doré (Carleton Opinion Research Ltd.)
F. I. Friedman (du Pont of Canada)
M. Fruitman (Woods, Gordon & Co.)
Miss P. Fry (McClelland & Stewart)
J. A. Fortin (Canadair)
*P. S. Grant (McCarthy & McCarthy)
E. A. Kangas (Bell Canada)
J. C. Madden (Computing Devices of Canada)
A. Maisonneuve (CEGIR)
**J. Stoddart (Hospital-Sick Children)
R. H. Taylor (National Film Board)
*D. H. Thain (University of Western Ontario)
H. J. von Baeyer (Acres InterTel)
Miss J. M. Wright (Computel Systems Ltd.)

Legend: *part-time
**6 months duration or less

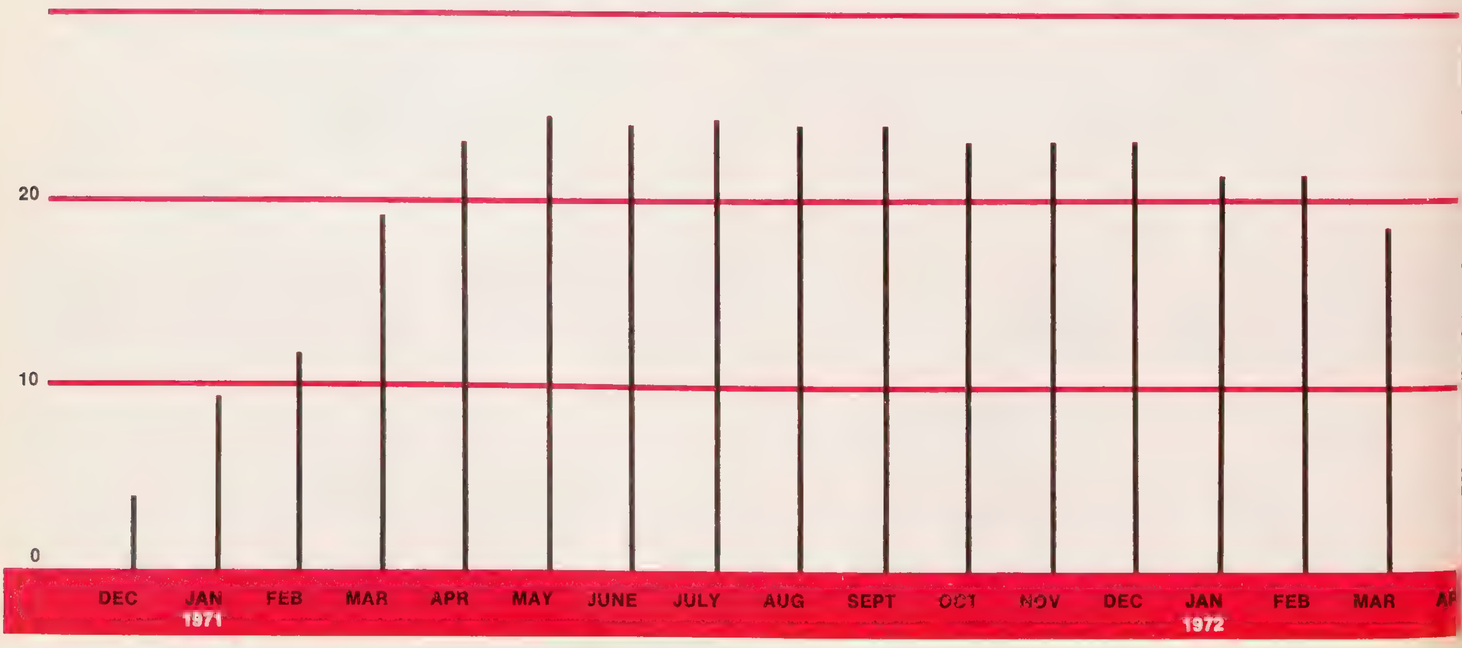
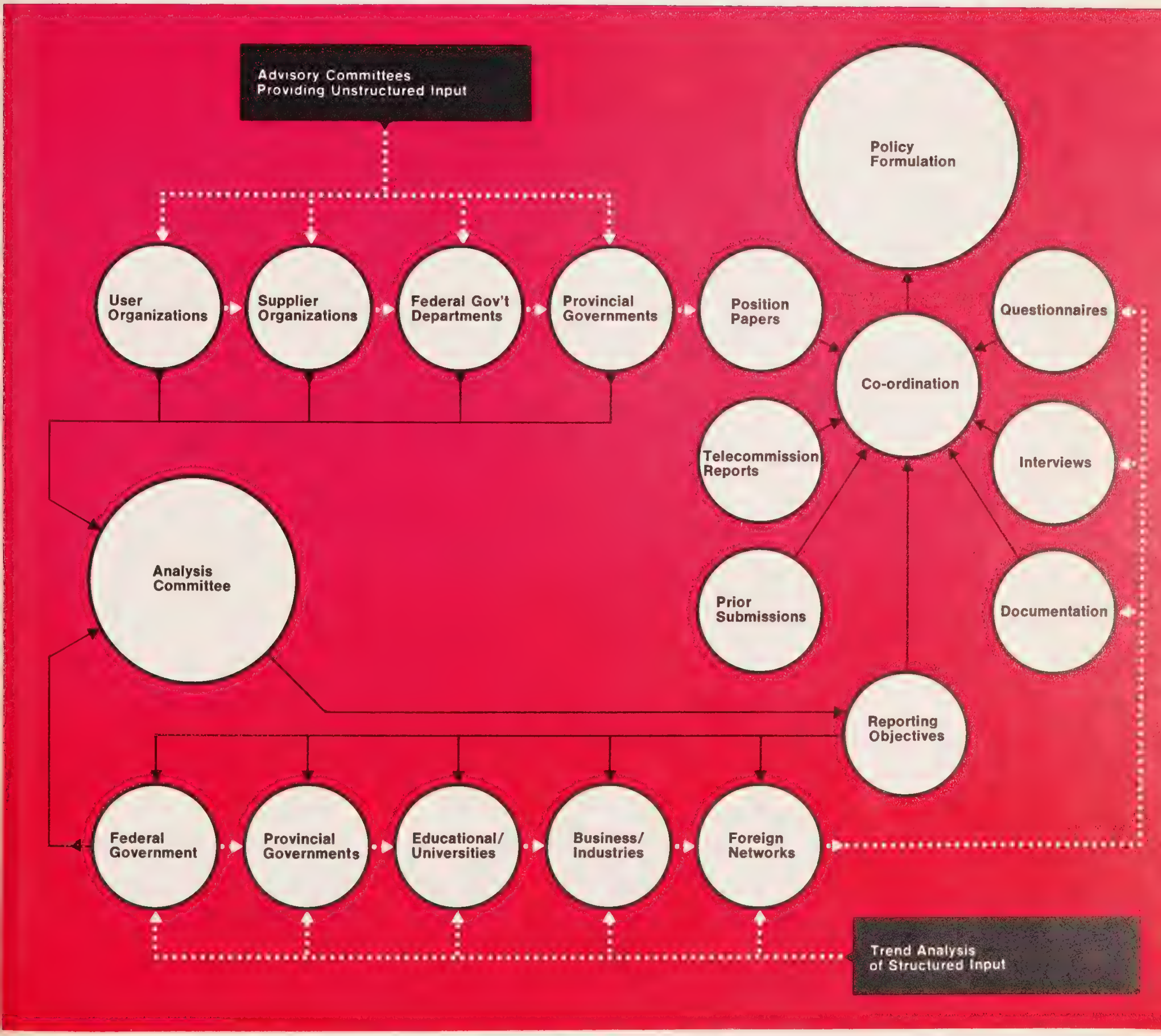


Figure 16
Fact-Finding Mission



(b) Task Force Investigations

In addition to obtaining the information on areas of concern, as expressed in the position papers and discussions outlined in (a) above, the Task Force investigated a number of aspects of computer/communications, using the telecommission reports as a starting point.

Some 60 major users of data communications in the private sector were visited to elicit information on their problems and technological, economic and operational service requirements in regard to data communications, and to obtain information on possible future requirements for a data communications network. A similar number of users in business and industry were also visited to obtain information on their use of computers, and to uncover trends, problems and issues relating to the future use of computer/communications.

Information was obtained from provincial authorities on their activities in the computer/communications field. In addition, twenty-eight universities were visited and information obtained on their present and potential use of computer/communications. They also co-operated in an investigation of the data processing services offered commercially by universities.

In the federal government, two parallel investigations were conducted by other government bodies. An assessment of government policies on internal use of electronic data processing services and facilities was carried out by the Administrative Policy Branch of the Treasury Board Secretariat. In addition the Government Telecommunications Agency (Department of Communications) investigated the use of telecommunications, including data communications, in the federal government. The information obtained in these two investigations was made available to the Task Force. Furthermore, the Task Force obtained information on specific points from individual departments.

Considerable time was devoted to a consideration of legal and constitutional issues. The Task Force also was engaged in a number of more specific investigations. Three of these, in socially significant areas, are published in Volume II of this Report. Other areas covered include technology forecasts, and technological aspects of data networks in foreign countries. The Task Force provided both financial and manpower support to the Task Force on Privacy and Computers, and there was a free exchange of information between the two bodies.

(c) Contract Investigations

In addition to the solicitation of position papers, and the investigations by Task Force personnel, a number of contracts were let for specific investigations. A list of these is given at the end of this Appendix.

One of these studies was designed to obtain a perspective of the hardware and services supply segments of the computer/communications industry, their inter-relationships, financing and ownership patterns and other significant factors. Another investigation in the private sector covered an assessment of

the use of foreign data processing services accessed from remote terminals for the analysis of seismic data. Other contracts covered an assessment of problems of smaller service bureaux in different parts of Canada.

In order to evaluate the importance of the trend towards the use of U.S. computer facilities by Canadian firms connected to them via telecommunications lines and remote terminals, an attempt was made to assess the trends of north-south data traffic and of its effect on the Canadian market. To assist in this evaluation, a consultant contract was awarded to conduct a Delphi forecast of the role of U.S. data processing and information industries in the Canadian market covering the time period between 1975-85.

As to social aspects, the Task Force provided part of the funds for a survey undertaken by Canadian Facts Co. Ltd., into social and cultural attitudes of Canadians towards computers and computer-services. In the area of community information-systems, a study was submitted by the Consumers' Association of Canada. Another contract investigation covered CATV technology for citizen feedback from citizens to government.

The Task Force also provided part of the funds for a pilot-system conducted by the Board of Education of Peel County, Ontario. The objective was to evaluate the effectiveness and desirability of computer-based administrative techniques in schools.

3. POLICY DEVELOPMENT

Following, and to some extent parallel with, the fact-finding phase of operations of the Task Force, many discussions centred on definitions of objectives and development of a cohesive policy framework. Early in the discussions, a set of decision criteria (Chapter III) was derived and, at a later stage, a metagame analysis of possible options was undertaken.

The findings presented in the telecommission studies, and discussions of options they contained, were reviewed and taken into consideration by the Task Force.

This phase of the work of the Task Force was a lengthy iterative process because of conflicting requirements and opposing points of view, and the many incompatible solutions to isolated problems.

A Progress Report was issued in June, 1971, and a summary of conclusions containing draft recommendations was submitted to Cabinet in December, 1971.

Companies and Organizations which have Contributed through Submissions and Task Force Surveys. (See also further lists of contacts mentioned in the Appendices of the Studies presented in Volume II, Part B.)

Abitibi Paper Company Ltd.
Acres InterTel Limited
Action Data Ltd.
AGT Data Systems, Limited
Air Canada
Alberta Government Telephones
Algoma Steel Corporation, Limited
Alpha Data Ltd.
Alphatext Systems Limited
Aluminum Company of Canada, Limited
Amoco Canadian Petroleum Company Ltd.
Andrew, D.J.
The AquiData Company Limited
Arcweld Products Limited
Argus Computer Applications
Association of Consulting Engineers
Association for Systems Management (Ottawa Valley Chapter)
Atomic Energy Control Board
Atomic Energy of Canada Limited
Automatic Electronic Systems Inc.
Banque Canadienne Nationale
Banque Provinciale du Canada
Bapco Paint Ltd.
B.C. Forest Products Ltd.
Bell Canada
Blair, A.B.
Bombardier Limited
The Borough of East York
British Columbia Packers Limited
British Columbia Telephone Company
Britton, D.
Burns Bros. and Denton Limited
Burns Food Limited
Burroughs Business Machines Ltd.
Calgary Power Ltd.
Canada Packers Limited
Canada Permanent Mortgage Corporation
Canada Safeway Limited
The Canada Systems Group
Canadair Limited
Canadian Association of Data Processing Service Organizations
The Canadian Bankers' Association
Canadian Bechtel Limited
Canadian Book Publishers' Council (and Canadian Copyright Institute)
Canadian Breweries/Rothmans of Pall Mall Canada Limited
Canadian Broadcasting Corporation
Canadian Business Equipment Manufacturers Association
Canadian Cablesystems Limited
Canadian Cable Television Association
Canadian Chamber of Commmerce
Canadian Construction Association
Canadian Data Centre
Canadian Export Association
Canadian Federation of Insurance Agents and Brokers Associations
Canadian Forest Products Ltd.
Canadian General Electric Company Limited
Canadian Imperial Bank of Commerce
Canadian Indemnity Company
Canadian Industries Limited
President, Canadian Information Processing Society
Canadian Institute of Steel Construction
Canadian International Development Agency
Canadian Kodak Sales Ltd.
Canadian Life Insurance Association
Canadian Manufacturers' Association
Canadian Marconi Company
Canadian Pacific Railway Company
Canadian Patents and Development Limited
Canadian Radio-Television Commission
Canadian Standards Association
Canadian Tire Corporation Limited
Can-Am Systems
Carleton University
CDP Computer Data Processors Ltd.
Centi (Canada) Ltée.
Central Data Systems Ltd.

Centre de gestion et traitement de données
Centre d'informatique Alpha Inc.
Centre informatique Calculus Ltée.
Cesco Electronics Ltd.
Chrysler Canada Ltd.
CN/CP Telecommunications
Coca-Cola Ltd.
Cogena Inc.
Columbia Cellulose Company, Limited
Columbia Computing Services Ltd.
Combined Market Quotations Ltd.
Comité conjoint de l'industrie de la construction de la région de Montréal
Commercial Data Services
Commonwealth Holiday Inns of Canada Limited
Company of Young Canadians
Compscan Ltd.
Computec Data & Control Applications Ltd.
Computech Consulting Canada Ltd.
Computel Systems Ltd.
Computer House
Computer Resources Ltd.
Computer Sciences Canada Ltd.
Computing Devices of Canada Limited
Comserve Ltd.
Com-Share (Canada) Ltd.
Confederation Life Insurance Company
Consolidated Computer Limited
Consultec Canada Ltd.
Consumers' Gas Company
Consumers Glass Co. Limited
Control Data Canada, Ltd.
Corporation of Thunder Bay
Cover-All Computer Services Ltd.
Crown Life Insurance Company
Cunningham Drug Stores Ltd.
Cytronics Corp.
Dalhousie University
Data Consultants
Data Management Systems
Dataline Systems Limited
Dataplus Ltd.
Datapro
Data Processing Management Association (Atlantic Chapter)
Data Tech Systems Ltd.
de Havilland Aircraft of Canada, Ltd.
Delstar Data Processing
Department of Agriculture
Department of Consumer and Corporate Affairs
Department of the Environment
Department of Finance
Department of Indian Affairs and Northern Development
Department of Industry, Trade and Commerce
Department of Justice — Attorney General
Department of Labour
Department of Manpower and Immigration
Department of National Defence
Department of National Health and Welfare
Department of National Revenue (Customs & Excise)
Department of National Revenue (Taxation)
Department of Public Works
Department of Regional Economic Expansion
Department of Solicitor General
Department of Supply and Services (Services)
Department of Supply and Services (Supply)
Department of Veterans Affairs
Digital Equipment of Canada Ltd.
Direct Winters Transport Ltd.
Dominion Foundries and Steel Limited
Domtar Limited
Dow Chemical of Canada, Limited
Drug Trading Company Limited
du Pont of Canada Limited
The E.B. Eddy Company
edmonton telephones
EDP Industries Limited
Electrodesign Limited
Electronic Industries Association of Canada
Emco Limited
Empire Data Centres Ltd.
Falconbridge Nickel Mines Limited
Federal Grain, Limited
Ferranti-Packard Limited

Financial Research Institute
Firestone Tire and Rubber Company of Canada, Limited
Ford Motor Company of Canada, Limited
Foremost Data Centre Ltd.
Gambles Canada Limited
Gandalf Data Communications Ltd.
Garrett Manufacturing Limited
Garritsen, J.B.J., C.A.
GAZ Métropolitain, Inc.
General Foods, Limited
General Motors Corporation
Goodyear Tire & Rubber Company of Canada, Limited
Government of the Northwest Territories
Great-West Life Assurance Co.
Guardian Ventures Limited
Gulf Oil Canada Limited
Harris & Partners Securities Limited
H.J. Heinz Company of Canada, Ltd.
Hewlett-Packard (Canada) Ltd.
M.P. Hofstetter Ltd.
Honeywell Information Systems
Horth Forestry Limited
Hunter Douglas Canada Limited
Hydro-Québec
I.A.C. Ltd.
IBM Canada Ltd.
Imperial Oil Limited
l'Industrielle Compagnie d'assurance sur la vie
Infopro Ltd.
Informatel (S.N.I. Inc.)
Instronics Limited
Interior Data Processing Ltd.
International Computers of Canada Limited
International Computer Optics
International Harvester Company of Canada, Limited
Interprovincial Pipe Line Company
J.D. Irving Ltd.
Irving Oil Company, Limited
Kates Peat Marwick & Co.
Kimberly-Clark of Canada Ltd.
Kurtz & Steel Ltd.
John Labatt Ltd.
Lakehead University
Lanpar Ltd.
Laurentian University of Sudbury/ Université Laurentienne de Sudbury
Laurentide Financial Corporation Ltd.
Leigh Instruments Ltd.
Lenkurt Electric Co. of Canada, Ltd.
M. Loeb Limited
London Life Insurance Co.
Macdonald Dettwiler & Associates Ltd.
MacMillan Bloedel Limited
Maislin Transport Ltd.
Manitoba Telephone System
Manpac Data Centres Ltd.
Manufacturers Life Insurance Company
Maritime Electric Company Limited
Massey-Ferguson Limited
McGill University
McMaster University
Memorial University of Newfoundland
Merck Frosst Laboratories
Metropolitan Life Insurance Company
Ministry of Transport
Mitches & Mitches
The Montreal Stock Exchange
Moore Corporation, Limited
Multiple Access General Computer Corporation Limited
Multitek
National Arts Centre Corporation
National Association of Canadian Credit Unions
National Capital Commission
National Cash Register Company of Canada, Limited
National Film Board
National Library
National Research Council of Canada
National Sea Products Limited
New Brunswick Telephone Company Limited
Newfoundland & Labrador Computer Services Ltd.
Newfoundland Telephone Company Limited
Noranda Mines Limited
Northern Electric Company Limited

Northern Telephone Limited and
Téléphone du nord de Québec, Inc.
Olivetti Canada Ltd.
Ontario Northland
Orenda Limited
Outboard Marine Corporation of Canada Ltd.
Pacemaker Business Machines Ltd.
Pacific Brewers Distribution Ltd.
Pacific Data Systems Ltd.
PEACS Pan-American Engineering & Computing Services Ltd.
Pioneer Computing Services Ltd.
Pirelli Cables, Limited
Placer Development Limited
PolyCom Systems Limited
Polymer Corporation Limited
Post Office Department
Privy Council Office
Province of Alberta
Province of British Columbia
Province of Manitoba
Province of New Brunswick
Province of Newfoundland
Province of Nova Scotia
Province of Ontario
Province of Prince Edward Island
Province of Québec
Province of Saskatchewan
Quantum Information Resources Ltd.
Québecair
Queen's University at Kingston
RCA Limited
The Reader's Digest Association (Canada) Ltd.
Recognition Equipment (Canada) Ltd.
Research Council of Alberta
Retail Credit Company of Canada Ltd.
Retail Merchants Association of Canada
Reynolds Aluminum Company of Canada Ltd.
Richardson Securities of Canada Inc.
Riley's Datashare International Ltd.
Rotem Industrial Products Limited
The Royal Bank of Canada
Royal Canadian Mounted Police
The Royal Trust Company
Ryerson Polytechnical Institute
Saskatchewan Telecommunications
Savage Shoes (1970) Limited
SDI Associates Ltd.
Secretary of State Department
Setak Computer Services Corp. Ltd.
I.P. Sharp Associates Limited
Shell Canada Limited
Sherwin-Williams Co. of Canada Limited
Simon Fraser University
Simpsons, Limited
Simpsons-Sears Limited
Singer Company of Canada Ltd.
Sir George Williams University
Skil-Share of Ontario, Ltd.
S.M.A. (Société de Mathématiques Appliquées) Inc.
Smith Transport Ltd.
SNC Computation Ltd.
La Société des Artisans Co-opérative d'Assurance-Vie
Société Générale de l'Informatique
Le Soleil
Spectrum Data Systems Ltd.
Stanfield's Limited
Stark Electronic Instruments Ltd.
Steinberg's Limited
Stevenson & Kellogg Ltd.
Sun Life Assurance Company of Canada
Syner-Data Canada Ltd.
Systems & Management Services Ltd.
Systems Corporation Limited
Systems Dimensions Limited
Systems Equipment Limited
Tahsis Company Ltd.
Telegram Publishing Company Ltd.
Telesat Canada
Telex Ltd. Computer Products
Texaco Canada Limited
The Thorne Group Ltd.
Ticket Reservation Systems, Inc.
The Toronto Stock Exchange
Traders Group Ltd.
Trans-Canada Pipe Lines Limited
Trans-Canada Telephone System
Trimac Transportation System
T-Scan Limited
Unemployment Insurance Commission
Unicom Data Services Ltd.
United Funds Management Ltd.

UNIVAC Division, Sperry Rand Canada Limited
Université Laval
Université de Montréal
Université d'Ottawa/University of Ottawa
Université du Québec
Université de Sherbrooke
The University of Alberta
The University of British Columbia
University Computing Canada Ltd.
University of Guelph
The University of Manitoba
University of New Brunswick
University of Prince Edward Island
University of Saskatchewan
University of Toronto
University of Waterloo
The University of Western Ontario
University of Windsor
Urban Computers Ltd.
Hiram Walker & Sons, Limited
Warner-Lambert Canada Ltd.
Waterfront Employers of B.C.
Wisener and Partners Company Limited
Wood Gundy Limited
Woodward's
Xerox of Canada Ltd.
Xyno Plastics Ltd.
Yetnikoff, Trudeau, Levi, Cooper & McGraw Inc.
York Data Centre
York University
Zurich Life Insurance Co. of Canada Ltd.

SPECIAL STUDIES BY CONSULTANTS OUTSIDE OF THE TASK FORCE

Consultants	Study
AGT Data Systems, Limited	Canadian Computer Industry Survey and Analysis (Ontario/Quebec)
Barkhouse, S.B.	Survey of Some Smaller Companies in the Canadian Data Processing Industry in the Maritime Provinces
Bell Canada	Local Facility Study
Bell-Northern Research	Computer/Communcations Network Study
Canadian Facts Co. Limited	Attitudinal Survey
Canuck Survey Systems, Ltd.	Seismic Data Survey
Consumers' Association of Canada	Study of Community Information Networks, Project INFO/CIN
Display and Decision Systems, Limited	Survey of Some Smaller Ontario Companies in the Canadian Data Processing Industry
Forsyth, G.R.	Canadian Computer Supply Industry Study
Guité, M.	CATV Technology for Citizen Feedback to Government
Hayward Computer Corporation Limited	Canadian Computer Communications Task Force Strategy Options
Howard, N.	Metagame Analysis of Computer/ Communications Policy Options
Institute for the Future	Policy Option Effects Study
Samson, Belair, Riddell & Stead, Inc.	Survey of Some Smaller Quebec Companies in the Canadian Data Processing Industry
Syndex Data Services Ltd.	Survey of Some Smaller B.C. Coast Companies in the Canadian Data Processing Industry
T-Scan Limited	A Pilot Information System Covering Administrative Functions for the Peel County Board of Education

Appendix 2

EXCERPTS OF CARRIER TARRIFS

1. CN/CP TEL TARIFFS

The following section, while lengthy, deserves to be quoted in full.

Tariff CTC 138 — Page 22
Tariff CTC 39 — Effective: August 1, 1970
Issued: July 14, 1970

GENERAL TARIFF

"*4.7 Use of Service by Subscribers*

(a) Facilities furnished under this tariff may be employed for the private use of those companies whose offices are connected to the channels, their affiliated and subsidiary companies and their representatives, and each such office shall transmit and receive its particular communications and those of its affiliated and subsidiary companies and their representatives over the equipment installed therein. Further such facilities shall not be used either directly or indirectly for the handling of communications for the public or any person, firm or corporation other than those whose offices are connected to the channels or their affiliated and subsidiary companies and their representatives, *nor shall such facilities be used for any purpose for which a payment or other compensation for such use shall be received by the subscriber, or an authorized user, from any other person, firm or corporation.* The restrictions set forth in this paragraph do not apply to facilities furnished to another communications common carrier.

(b) In the event of a dispute between the Telecommunications Company and the subscriber as to the use of the facilities, *the Telecommunications Company's decision shall be final* and binding upon both parties."

Tariff CTC (TG) 138 — Page 107
Tariff CTC (TG) 39 — Effective: August 1, 1970
Issued: July 14, 1970

"Item 22.0 CHANNEL — DERIVING ARRANGEMENTS (Continued)

22.4 ARRANGEMENTS PROVIDED BY THE SUBSCRIBER

(2) The connection of the subscriber-provided equipment is permitted subject to conditions as follows:

(a) The subscriber is responsible for the maintenance of his own equipment.

(b) Channels *may not be used to connect to any form of switching system,* including store and forward or line switching, other than the Telex network, which may be connected at the *discretion* of the Telecommunications Company."

Comment: (b) is consistent with the CN/CP Tel request to the telecommission (Telecommission Study 8b (ii)) for exclusive right to use of store and forward technology, and it clearly relates to maintenance of the concept that "switching" is a vested monopoly right of a common carrier.

Tariff CTC (TG) 137A	Page 8
Tariff CTC (TG) 38	Effective: August 1, 1970
	Issued: June 30, 1970

"Item 8. JOINT USER SERVICE

8.1 Joint User Service is the use of a subscriber's service by another individual, firm or organization *whose requirements do not warrant subscribing for a separate service.*

8.2 *Joint User Service is not in accord with the general plan* of furnishing Telex and Datatelex Service, and shall be furnished only at the discretion of the Telecommunications Company. Furthermore, the Telecommunications Company reserves the right to limit the number of joint users in order to avoid impairment of the service.

8.5 The Joint User must be located in the *same room or suite of rooms* as that in which the station is located.

8.6 Separate signalling arrangements shall not be provided for the purpose of signalling the Joint User."

Comment: This Tariff clearly restricts any subscriber from realizing opportunities for reducing his operating cost by sharing or sub-leasing of not fully-utilized services, by requiring it to be done with the cognizance and also under the control of the carrier. The regulation of separate signalling and requirement of joint users to be under the same roof severely limit the prospects for shared usage.

Tariff CTC (TG) 139	Page 7
Tariff CTC (TG) 40	Effective: August 1, 1970
	Issued ; July 20, 1970

SPECIAL TARIFF

''4. *Computer Services*

The Telecommunications Company may levy charges against subscribers of its Computer Switched Service offerings, as well as against subscribers operating Computer Time Sharing Systems, based on *the particular circumstances* associated with each particular subcriber's requirements. When these requirements become more standardized and less custom-designed, the charges for major services will be filed as items in a General Tariff.''

Comment: The phrase ''may levy charges'' perhaps raises the question as to what are the user prerogatives of appeal.

Tariff CTC (TG) 137A	Page 53
Tariff CTC (TG) 38A	Effective: August 4, 1970
	Issued: July 15, 1970

SECTION V
TELEX COMPUTER INQUIRY SERVICE

''1. GENERAL

1.1 *This service provides for flat rate charges,* in lieu of tolls, for communication originated by Telex or Datatelex outstations to a centralized computer and is designed for operation at signalling speeds up to 180 bauds.

This service is subject to all terms, conditions and limitations of liability specified in Section 1, Item 1 to 9, both inclusive.

1.2 This service consists of two separate offerings:
a) *Flat rate calling* for outstations located in the same city service area as the centralized computer.

b) *Flat rate* calling for outstations located in cities other than the same city service area as the centralized computer.

1.3 Service is furnished subject to the availability of facilities and is only available within Canada.

1.4 Unequipped Telex or Datatelex lines connected between the Telex exchange and the centralized computer are provided at standard tariff rates.

1.5 Terminal equipment at the outstations may consist of standard Company offerings, or may be provided by the customer.

1.6 This tariff covers communication originated by the outstations only, however, *the centralized computer may originate calls using other standard tariff offerings of the Company.*

1.7 When technically feasible outstations may communicate with other outstations and other Telex or Datatelex subscribers at standard Telex tariff rates. Each individual case should be referred to the General Sales Manager.

1.8 The initial service period is one month.''

Comment: This tariff is an interesting application of flat rates specifically for a computer network. The ''computer'' referenced in the text might for example be that of Computer Sciences of Canada Ltd. (an affiliate of CN/CP) as described in a press release made in 1971:

''Computer Sciences Canada recently introduced a service to small business users that will allow interactive timesharing access to Univac 1108s in Toronto and Calgary via a local Telex call.
''The system allows Telex users to access the CPUs at regular CSC rates plus a $15/mo. telecommunications computer inquiry service charge from Canadian National and Canadian Pacific (CNCP) which provide the Telex lines and equipment.
''Although a $50 initiation charge and a $25/mo minimum fee are also required of users, CSC said the service will allow 'unsophisticated' users the capability to use basic 5-level Telex terminals to do accounting, payroll and other necessary functions that would otherwise not justify the installations of an in-house CPU or more expensive interactive terminals.''
''A Telex subscriber accesses a CPU calling the local CSC branch which then multiplexes the call into one of the 1108s.''

This case illustrates a number of points:

- It is an application of flat rates where the mileage charge is constant over successive zones, but charges are still proportional to time used.
- The service offered by CSC requires use of the tariff noted, combined with tariffs 138-39 which permit an extension of the service between cities and termination through the Telex switched network but ''at the discretion of the Telecommunications Company''.
- It illustrates some of the confusing complexities which face subscribers dealing with tariffs.

2. BELL CANADA TARIFFS

Selection of Bell Canada tariffs rather than those of B.C. telephones is based upon dominant position of the former within TCTS. Other TCTS members are not under federal regulation.

Tariff CTC (TP) No. 6716

ARRANGEMENTS FOR DATA TRANSMISSION

Item 4660-10 Channel-Deriving Arrangements

''(a) A channel-deriving arrangement enables a customer to a data channel to obtain from it two or more data channels of a narrower band-width. The arrangement may be provided by the Company or by the customer.

"(c) Arrangements provided by the customer:

> "(3)b. The equipment will not be used to connect *customer-provided concentration or switching systems.*"

(Page 504, Issued May 19, 1971, Effective June 2, 1971.)

Comment: A clear statement of prohibition of sharing or re-sale by users.

Item 4680 Systems and Services for Data Transmission (Page 518, Issued November 9, 1970, Effective December 1, 1970.)

> *"3 Multicom Service*
>
> (a) Multicom service is furnished for the transmission of data between stations of customers located in the local service area of certain exchanges. It is furnished between data equipment provided to operate at the *same speed* and where the customer's equipment arrangements are compatible.
>
> "(c) *The Company determines the exchanges between which it will provide the service."*

Comment: — Bell Canada decides which subscribers are to obtain the services. Also the restrictions on speed and compatibility of terminals would be unnecessary in a digital network designed solely for data transmission. To this extent the tariff reflects the state of the art within Bell's services.

Bell Act and Attachments — The following is a quotation from Chapter 48, 1967-68:

> "5(4) For the protection of the subscribers of the Company and of the public, any equipment, apparatus, line, circuit or device not provided by the company shall only be attached to, connected or interconnected with, or used in connection with the facilities of the Company in conformity with such reasonable requirements as may be prescribed by the company.
>
> "(5) The Canadian Transport Commission may determine, as questions of fact, whether or not any requirements prescribed by the Company under subsection (4) are reasonable and may disallow any such requirements as it considers unreasonable or contrary to the public interest and may require the company to substitute requirements satisfactory to the Canadian Transport Commission in lieu thereof or prescribe other requirements in lieu of any requirements so disallowed.
>
> "(6) Any person who is affected by any requirements prescribed by the Company under subsection (4) of this section may apply to the Canadian Transport Commission to determine the reasonableness of such requirement having regard to the public interest and the effect such attachment, connection or interconnection is likely to have on the cost and value of the services to the subscribers.

The decision of the Commission is subject to review and appeal pursuant to the Railway Act."

Comment: The Act is capable of being invoked in respect of all forms of communication, including data.

Control of attached data communications switching equipment will be a contentious issue which will be very difficult to resolve, especially where the user is also performing switching for processing.

APPENDIX 3

NOTES ON CARRIER DIGITAL TECHNOLOGY

1. TCTS DIGITAL TECHNOLOGY

The basic short-haul digital facility is the T1 (PCM) repeatered line. It operates at 1.544 megabits per sec. which is structured from 24 voice channels at 56 kilobits per sec. each with necessary control bits added. Data are to be serviced by using one to four of the 24 voice channels of a system. A new time slot access unit is being developed for this purpose. The range of the T1 is 50 miles. Its successor the LD1 will increase this to 200 miles.

By 1980 long haul systems may consist of co-axial cable; analogue microwave, digital microwave; and of microwave waveguide.

- LD4. This new co-axial voice system will have a capacity of 20,000 two-way voice channels and is planned for service in 1975. Digital techniques are employed. The bit rate hierarchy is an extension of the T1 system. It will be possible to introduce data channels into the multiplexers with the same restrictions as for T1. The cable will have 12 co-axial tubes each operating at 283 megabits per sec.
- Microwave. In the immediate future, as in the proposed pilot digital private-line network for Ottawa, Toronto and Calgary, standard frequency division multiplex will be used. This will constrain data signals to a standard voice group bandwidth of 48 kHz. Development of digital radio using other multiplexing techniques is underway in Canada. Not all of the work is being done by TCTS members or affiliates. Exploratory programs have been started to define the form of the digital radio system, which will operate above 12 GHz, because of the extended frequency spectrum requirements of the digital technique. At these frequencies "hops" are shorter and re-investment in digital radio for a coast-to-coast route would involve considerable capital sums. Much of the existing lower frequency plant has already seen 15 years service, which is more than half a life-span for electronic equipment. A definite replacement program has not been set out at this time, because there is no basis for predicting the time at which the traffic density will require the 12GHz facility.

Supplementing the digital network developments, local loop equipment is being developed. This will include a digital subscriber terminal, a local loop digital repeater and a central office regenerator. Synchronous data from a standard computer terminal interface can be transmitted direct to the central office in bit form. From here it can be "slotted" into T1 or the microwave carrier. The significant feature is the elimination of digital to analogue conversion and the MODEM required to perform this function. The TCTS paper[1] of July 1971 forecasts requirements for modems on a one-for-one basis with terminals through this decade and to a value of several hundred million dollars. If digital subscriber loops were to be extensively installed in the same period, the substitution of the less costly interfacing equipment needed in them could result in the elimination of much of this very large expenditure for modems. No network with modems can truly be said to be a

[1] *Computer Based Services of the Seventies* (Trans-Canada Telephone Service July 1971)

digital data network. Thus far, digital subscriber loop equipment is proposed only on a pilot scale. Further expansion will depend upon demand according to TCTS.

The subject of digital switching can be succinctly introduced by a quotation from a TCTS paper, as follows: "It is also considered essential that the future data network include a fully-switched service. This will involve digital high-speed switching, using both circuit-switched and message-switched modes. Stored program control is envisaged in both cases. Progress has been somewhat slower in the switching field, for it is only very recently that electronic crosspoints became comparable in cost with their mechanical equivalents. The projected availability of such crosspoints has triggered an exploratory development aimed at producing a time-division switching machine for telephony, data and video signals to be available about 1980. This machine will be the digital equivalent of today's large circuit switchers."[2]

The following facts should be considered before an assessment of the foregoing quotation is made. Switching is used to permit load-sharing by certain carrier facilities, to perform logical functions for the subscribers, and to facilitate billing. Data loads on trunks are still very light. For example the Ontario-Manitoba data load is not expected to exceed one-half the capacity of a T1 line by 1975. Data switchers are still so expensive relatively that it is cheaper to provide more lines than to share with the aid of a switcher. As long as private networks do not require intercommunication, logic functions will be tailored to specific systems and switching logic will not accumulate at big switching centers. Therefore, it is not obvious at this time just when large digital switches will be required for interconnection of digital networks.

Electromechanical switching has been carried to practical limits in both Broadband and Multicom. The set-up times and signalling techniques have been reduced and improved to the point of marginal return from further development of this type of equipment. Therefore, if the new solid-state crosspoint switchers are not to be introduced before 1980, data communications users will be seeking alternatives. One of these has already appeared. This is a new addition to the switching hierarchy which is evolving from an adaptation of mini-computers. The following quotation is from a recent TCTS press release.

"Announced in September, 1971, after *considerable pilot development*, Software Controlled Communications Services (SCCS) is a family of data services using mini computers as "front ends" for large host computers, as remote concentrators, message switchers, or combinations of these. The initial service will be to provide the front end communications controller. The other features to be offered in the future will be for private user and common user networks.

[2] *Communications, Computers and Canada* (Trans-Canada Telephone Service November 1971 revised December 1971)

"The advantages of SCCS systems include:

flexibility
the SCCS can handle a wide variety of speeds and transmission codes
expandability
the system can be easily extended
host computer economies
the host computer can be relieved of communications handling tasks which consume processing time and memory space
reliability
communications network reliability can be improved by continuous monitoring and diagnostic checking
economy
SCCS will be able to optimize the use of communications systems to the highest degree possible"

This raises the question whether the time-division switching machines of the early 1980's will have the capability of switching data with voice and video. At a recent European conference[3] on integrated voice, video and data, (the first of its kind on this theme) it was stressed that much work has still to be done with redundancy removal techniques, and that there is an unfortunate trade-off to be made in the use of such equipment which is more sensitive to noise as it becomes more efficient in removal of redundancy. As was revealed in one paper[4] bit rates associated with more advanced analogue services, such as holographic, long-three-dimensional video, which is the extreme case, requires manipulation of tens of billions of bits per second. This is beyond the state of the art, but even less sophisticated services will create great technical management problems. It was obvious at this conference that, in dealing with voice and data alone, the European community will avoid interconnections between analogue and digital networks via switches, although multiplex and transmission facilities will be used in common as in PCM systems.

Neither of the TCTS papers which have been quoted here has made reference to software developments which will be required to achieve digital switching. These developments will be substantial, and of no less significance in network development then switching hardware.

The economics of voice traffic fostered the development of first T1 and then LD4 for transmission links. As a consequence, the first digital networks will be essentially long-haul in nature, consisting mainly of dedicated circuits. Digital local loops and digital switches will likely be integrated into a Canadian digital data network subsequently, and in that order. Paradoxically the major Canadian industrial centres are located in the vicinities of large

[3] International Zurich Seminar on Integrated Systems for Speech Video and Data Communications Zurich Switzerland March 15-17 1972

[4] Huang T.S. and Stucki P. "Image Processing in Communications Systems" Conference Paper delivered at the International Zurich Seminar on Integrated Systems for Speech Video and Data Communications Zurich Switzerland March 15-17 1972

cities which are much more interurban than they are interregional in their business activities. Therefore, from the point of view of the supply of data communications alone to such economic complexes, a different sequence for development of network components would seem more timely to users needs. This sequence would be: digital local loops, concentrators, short-route PCM followed by digital switchers, and the digital long-distance facility. In the pragmatic economics of the carriers there is no realism in such a supposition. Thus the TCTS position is that data communications are economically viable only if provided as a supplement to voice facilities. Any review of carrier data communications network proposals must take this postulate into consideration. Such time-sequence considerations, however, should not minimize the very promising technical developments which the telephone carriers intend to effect in data communications in Canada, in this decade.

2. CN/CP TEL DIGITAL TECHNOLOGY

The plans of the telegraph carriers for network development are conditioned by the fact that there is no vertically integrated manufacturing industry associated with them. The world is their market-place for acquisition of new technology. This results in lack of flexibility in system-design where there are major requirements peculiar to the Canadian environment. The Canadian market simply is too small to influence the features of equipment which is designed for world markets. On the other hand, the telegraph carriers can sometimes move quickly into a procurement cycle to establish new plant when the world suppliers by their research and development programs have effectively anticipated Canadian data communications requirements.

The telegraph carriers plan to supply T1 with low- medium- and high-speed multiplexers for data services. Commercial equipment will be used which means that it will conform to the voice hierarchy in bit rates.

CN/CP Tel proposals are to convert existing Telex junction exchanges to electronic switches and to use electronic concentrators to eventually replace all of the smaller district and sub-district exchanges.

The facilities may all be provided by a new switching technology which is being developed at various places in other countries. One example is the EDS family of equipments, developed and supplied by Siemens, Germany. This system is the first digital switch which has been designed for digital data services specifically, and in fact will not accommodate voice. The techniques employed in it are suitable for asynchronous low speed data, or Telex. It has limitations when used in synchronous systems.

The telegraph carriers lease local loop facilities from the telephone carriers. Therefore they do not have full freedom to plan in this area and have asked for government support to ensure long-term continuity in usage of local loops.

The new switching complex will require an investment of 50-100 million dollars to develop in Canada. The concept could be very strong in developing urban systems consisting of digital switchers, concentrators and local loops,

but would not be compatible in a network linking it with those TCTS facilities which are to be made available in this decade. This prospect emphasizes the fact that switching will be the key factor in the development of digital data facilities in Canada. An overall national network cannot be developed without a homogeneous switching hierarchy.

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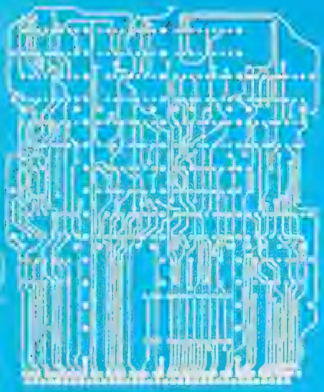

Machines and computers should become a functional part in a life-oriented social system and not a cancer which begins to play havoc and evantually kills the system.

Eric Fromm
The Revolution of Hope

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Report of the Canadian Computer / Communications Task Force

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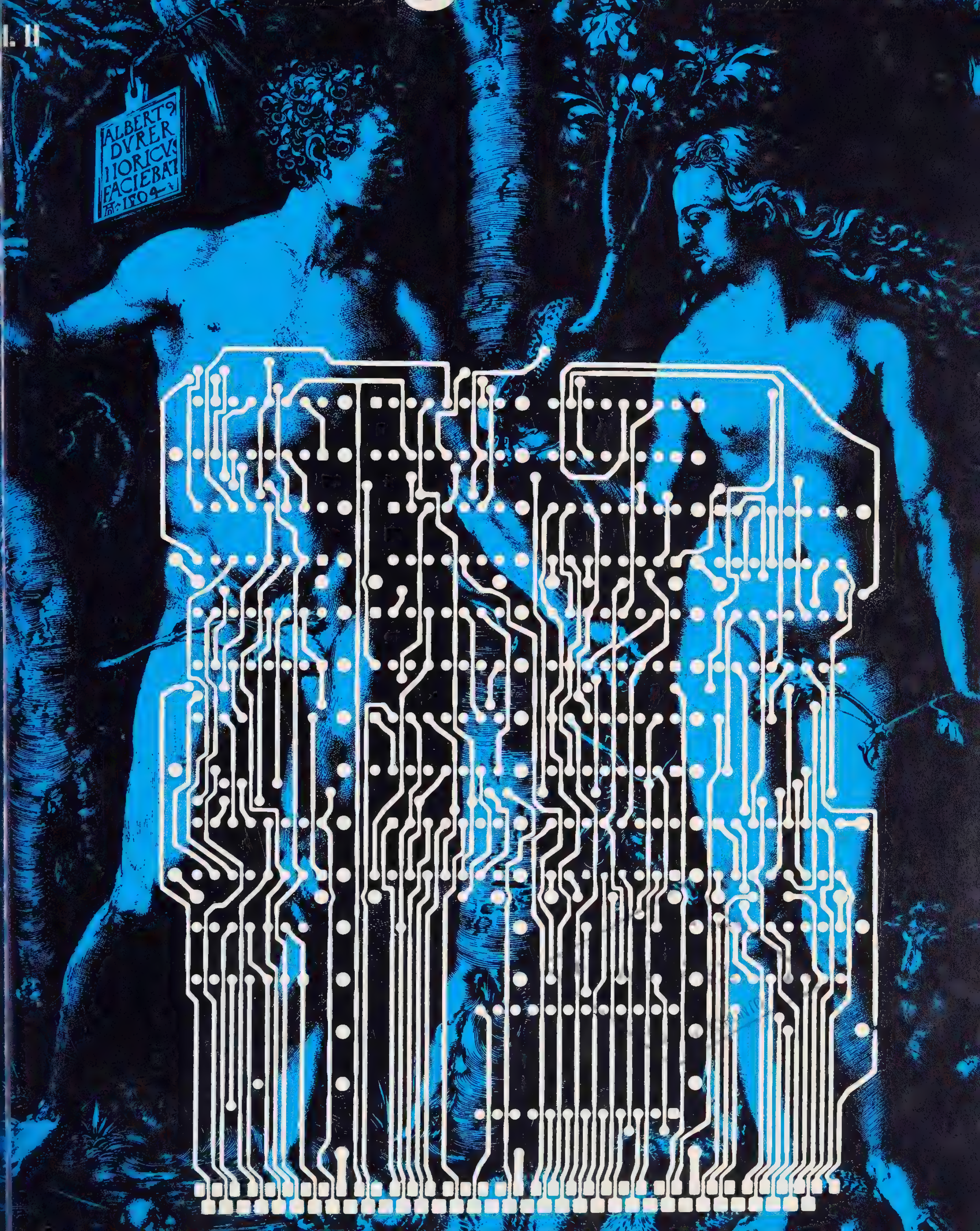

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Information Canada
Ottawa, 1972

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Report of the Canadian Computer / Communications Task Force

Vol. II

Department of Communications
Ottawa, May, 1972

Cover design, figures and tables conceived by Gilles Robert + associés, inc.
Editors: Pamela Fry and Fernand Doré.

Conception graphique de la couverture, des figures et des tableaux: Gilles Robert + associés, inc.
Révision et conception de la publication: Pamela Fry et Fernand Doré

This Report in all its aspects represents the work of an independent Task Force. The views expressed are not necessarily those of the Department of Communications or of the Government of Canada.

VOLUME II

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Preface

Volume II of this Report consists of two parts.

Part A contains a background paper on the present jurisdictional and legal aspects of computer/communications in Canada, which is necessary to an understanding of implications and recommendations in Volume I. It provides an overview of the present jurisdictional setting, describes the present roles of the regulatory agencies affecting computer/communications and comments on a number of legal issues.

Part B comprises three studies which provide a picture of the present involvement and future possibilities of computer/communications methods in fields of broad social significance. The survey areas, financial transactions, education, and health care, were selected because of their great public interest and social importance, and because they are being markedly affected by the introduction of computer methods.

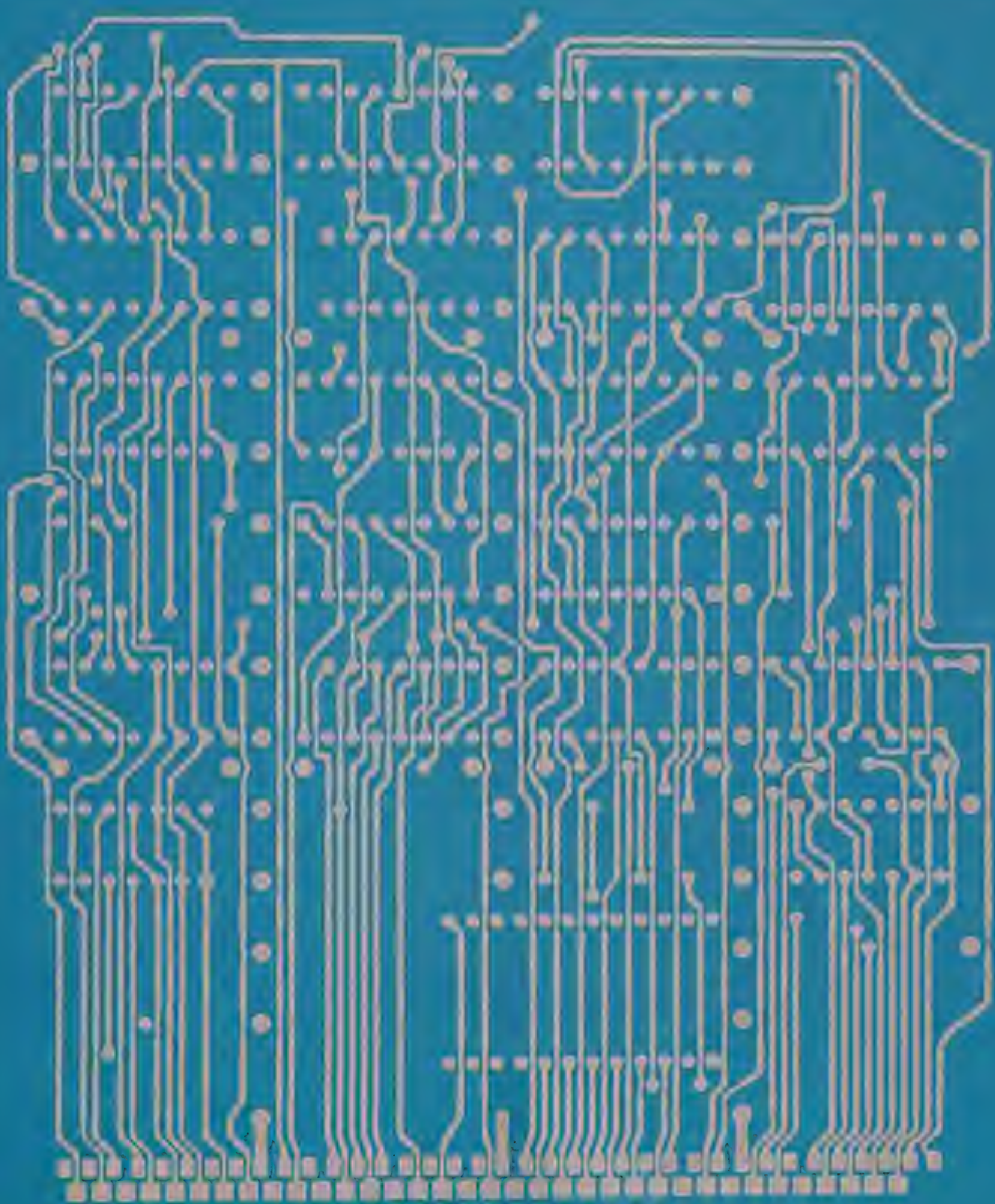
It is emphasized that these three studies are not intended to be a comprehensive treatment of the fields nor are these intended to add significantly to the technical knowledge of computer applications in these particular fields. The sole purpose of the surveys was to identify the extent to which computer/communications methods have been and are being introduced into these areas in Canada and to obtain informed opinion on past experience and future expectations from those directly involved.

In this respect, the three studies represent background material to support the main mandate of the Task Force which is to develop recommendations for policies in the computer/communications field. If by the choice of words an impression is anywhere conveyed that these reports exceed the Task Force mandate and seem to indicate courses of action in the areas studied, this is unintentional and is due to the difficulties of keeping matters concerning specific technical means separate from those concerning the desired ends. Computer/communications is a tool for performing functions in a myriad of applications. The Task Force work has been concerned with the identification of common aspects in the application of this technology and recommending measures for its use to the greatest benefit of the people of Canada.

Part

A

Jurisdictional and Legal Aspects of Computer/Communications in Canada



INTRODUCTION

One of the primary concerns expressed in Volume I of this Report is the role of government: How should it act? What can it do? What legislative or administrative measures should be taken? In answering these questions, it is obvious that a clear picture must be formed of the present jurisdictional and regulatory realities in the computer/communications industry. What legislation affects this industry? Is this legislation achieving its purpose? Are there any legal or institutional impediments to the growth or rationalization of the industry to which government should address itself? What administrative tribunals regulate sectors of the computer/communications industry? Is the jurisdiction of these agencies sufficient for them to discharge their role? Are the policies and practices of regulatory bodies, as developed over the last few decades, appropriate for the present and future needs of the computer/communications industry; and, more importantly, for Canadian society as a whole? What changes seem to be desirable?

These questions obviously raise complex implications for government policy, and they are central and critical issues in the present context. Providing added impetus to the work of the Task Force has been the realization that, in the jurisdictional and institutional area, rational and forward-looking government measures must be developed expeditiously, lest the new technology develops so rapidly that it overtakes the capacity of government to deal with it.

The purpose of this part is threefold: first, to briefly outline the nature of the legislation affecting the computer/communications industry in order to provide an overview of the present jurisdictional setting; second, to examine the present role of the administrative agencies affecting computer/communications; and finally, to comment on a variety of constitutional and jurisdictional issues raised by the role of computer/communications in Canada. No recommendations as such are contained in this part, but the issues raised have been dealt with in recommendations in Volume I.

In examining these issues, it becomes immediately apparent that the present legislative framework for computer/communications in this country is complicated by the fact that the industry now operates at the level of an interface between two technologies which have begun to progressively overlap. One of these, the technology of telecommunications, has traditionally been viewed as a utility and has been subject to government regulation and in a number of cases to direct government operating control. The other technology — data processing — has evolved in a competitive framework, subject to little if any government regulation beyond the requirements imposed by legislation of general application. In reviewing the present legislative framework of the computer/communications industry, it is therefore useful to separate the two service components, and review them individually.

Accordingly, in the discussion which follows, the data communications sector of the industry is separated from the data processing sector for the purpose of analysis, and the legal issues relating to each are discussed in separate

sections. It is recognized that it is virtually impossible to make a clear distinction between the two sectors — computers are increasingly being used for ''communications'' functions as well as ''processing'' functions — but for regulatory purposes, the distinction is frequently a critical one. It is anticipated that as government intensifies its concern with the problems of the computer/communications industry, it will become of even greater importance to establish definitions for these and other matters in order to clarify the precise bounds of government regulation. Consequently, although no attempt is made at this point to define once and for all the functions of ''data communications'' and ''data processing'', reference is made in the notes to a number of statutory and administrative definitions that may serve as broad useful guide-lines.[1] The problems of interpretation raised by these definitions effectively illustrate the need for careful statutory drafting in the near future, so that definitions are employed that are as free from ambiguity as language permits, and that can be understood and uniformly applied by all interested parties.

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[1] At present, there is no commonly accepted definition for either ''data communications'' or ''data processing'' that effectively distinguishes between the two without unduly limiting the scope of either term The problem of adequate definition arises in a variety of other contexts in the telecommunication industry as well and may be highlighted by an examination of the problem of defining the meaning of ''telecommunications carrier'': see *Telecommission Study 1(c)* In the Radio Act, the term ''telecommunications'' is given an expansive definition, viz ''Any transmission, emission or reception of signs, signals, writing images of sounds or intelligence of any nature by wire, radio, visual or other electromagnetic system'' A similarly expansive definition is provided in the analogous American legislation where communications by wire or radio is defined to mean: ''the transmission of writing, signs, signals, pictures and sound of all kinds between the points of origin and reception of such transmission, including all instrumentalities facilities, apparatus and services (among other things, the receipt, forwarding and delivery of communications) incidental to such transmission'' A number of other definitions add an additional parameter by defining the term ''communications to mean: ''the transmission of messages between two or more points by wire, radio or other electromagnetic system, wherein the content of the message remains unaltered'' The distinction between data communications and data processing has been drawn for regulatory purposes by the FCC, for the purpose of its policy relating to carrier entry into data processing The FCC defines ''data processing'' as ''the use of a computer for the processing of information as distinguished from circuit or message-switching 'Processing' involves the use of the computer for operations which include among other things the functions of storing, retrieving, sorting merging and calculating data according to programmed instructions'' A variety of other authorities have also attempted to define such terms as ''computer'', ''voice communications'', ''remote access'' for regulatory purposes, but all of these definitions suffer from problems of ambiguity and imprecision

Chapter I
Legal and Regulatory Aspects of Data Communications

Chapter IV of Volume I gave some indication of the growing significance of the data communications segment of the computer/communications industry. Except where communication with computers is limited to the same building or complex of buildings, the transmission links between computers and users are normally furnished by the telecommunications carriers. The regulation of "data communications" in Canada is therefore based upon the regulation of the carriers providing such service. Since data communications is only one component of the over-all telecommunications service provided by the carriers, an enquiry into the regulation of data communications inevitably leads to an enquiry into the general jurisdictional framework for the regulation of telecommunications in Canada.

In contrast to the situation in the United States, where jurisdiction is split between local (intrastate) and long-distance (interstate) service, the regulation of telecommunications in Canada is exercised at present on a carrier-by-carrier basis, with each carrier subject to rate regulation in respect of all its services by either a provincial or federal regulatory tribunal. The particulars of the specific legislation that relates to the regulation of the telecommunications carriers have been examined in more detail in *Instant World* and in certain supporting Telecommission studies.[2] The following summary is restricted therefore to a description of aspects of the jurisdictional framework which touch directly on the questions dealt with in this report, namely, the provision of data communications and the review by the present regulatory agencies of computer/communications services.

1. DATA COMMUNICATIONS SUPPLIERS

Although there are literally hundreds of telecommunications carriers in Canada, the vast bulk of telecommunications service is provided by only 15 major telephone systems[3] and by the consortium of the two railway companies, Canadian National/Canadian Pacific Telecommunications. Two other carriers, Canadian Overseas Telecommunications Corporation and Telesat Canada, although given the power to deal directly with customers, have acted so far (save with respect to the CBC) as "carrier's carriers". These 18 major carriers are listed in the Appendix, along with notes as to their present size, operating territory, and ownership. The salient facts may be summarized as follows:

[2] See *Instant World A Report on Telecommunications in Canada* (Ottawa, Information Canada, 1971), pp 187-227 and *Telecommission Studies 1(a), 1(b), 1(d)* and *8(a)*

[3] The basis for the selection of 15 "major" telephone companies was an annual operating revenue in excess of $1 million in 1970, the most recent year for which figures are available See *Telephone Statistics: Preliminary Report on Large Telephone Systems, 1970* (Ottawa, Statistics Canada (Catalogue 56-202), November, 1971), and *Telephones and Cable Statistics, 1970* (Ottawa, Statistics Canada (Catalogue 56-201), October, 1971) Of these 15 systems, eight operate as members of the Trans-Canada Telephone System a voluntary association set up to provide co-ordinated telephone service across the country These 8 systems are British Columbia Telephone Company Alberta Government Telephones, Saskatchewan Telecommunications Manitoba Telephone System, Bell Canada, The New Brunswick Telephone Co Ltd, Maritime Telegraph and Telephone Co Ltd, and Newfoundland Telephone Co Ltd The remaining telephone systems listed, Okanagan Telephone Company, edmonton telephones, Thunder Bay Telephone System, Northern Telephone Limited, Téléphone du Nord de Québec Inc, Quebec Téléphone and Island Telephone Company Ltd, come to individual agreements with the connecting TCTS members regarding calls originated or received in their territories See *Instant World, supra*, note 2 at pp 67-71

The telephone systems listed in the Appendix account for 98% of the cost of plant for the telephone industry in Canada, 98% of the total revenue, and 99% of the total salaries and wages reported by all telephone systems. When supplemented by CN/CP Tel, these systems account for virtually all significant data communications activity in Canada.

Of the 18 carriers listed, only five — Bell Canada, British Columbia Telephone Company, CN/CP Tel, COTC, and Telesat Canada — are regulated federally.[4] However, these five carriers account for well over 75% of the operating revenues of the 18 systems. Of the revenues indicated for the 15 telephone systems in the Appendix, some 4% (or about $60 million in 1970-71) was derived from the transmission of data, including TWX, and from the rental of related equipment (much of this is not necessarily computer-related); in the case of CN/CP Tel, data communications (excluding such services as public message telegraph and video relay, but including TELEX) account for just over 50% of its revenue (or about $60 million).

The major telecommunications carriers identified in the Appendix are owned by a variety of interests. Bell Canada, a widely-held Canadian-owned public company, owns or controls the majority of the shares in six others of the carriers listed — Northern Telephone Limited, Téléphone du Nord de Québec Inc., The New Brunswick Telephone Company, Limited, The Island Telephone Company Limited, Maritime Telegraph and Telephone Company Limited, and Newfoundland Telephone Co. Ltd. Three other companies — British Columbia Telephone Company, its subsidiary Okanagan Telephone Company, and Québec-Téléphone are controlled by General Telephone and Electronics Corporation, a U.S.-owned communications conglomerate. Three carriers — Alberta Government Telephones, Saskatchewan Telecommunications, and Manitoba Telephone System — are Crown Corporations of the three Prairie provinces; two carriers — edmonton telephones and Thunder Bay Telephone System — are municipally owned. CN/CP Tel and Telesat Canada show mixed public and private involvement as well, while COTC is a federal Crown Corporation.

The services provided by the telecommunications carriers listed in the Appendix have different competitive characteristics. At one end of the scale are the monopoly services, *i.e.*, public telephone and message telegraph. These are traditional common carrier services, with a long history of government regulation on such matters as rate of return, discrimination and, in certain cases, obligation to extend service. In the middle of the scale are a variety of so-called private-line services which are available on the basis of limited carrier competition in Canada. These services include private-line voice or teletype (no access to the public telephone network), and line-switched

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[4] The term "regulation" is here used to denote present statutory potential rather than practical regulation in the administrative sense. All five carriers are incorporated at the Federal level but only Bell Canada, B.C. Telephone and CN/CP Tel are regulated in practice by the Canadian Transport Commission. COTC, although subject to CTC rate regulation under the *Telegraphs Act*, does not file its tariffs at present; these are determined instead by negotiations with connecting overseas carriers. Telesat Canada is also outside CTC jurisdiction at present.

services (such as TWX or Telex, Data Telex, and Broadband Exchange). Competition between telephone and telegraph companies is limited with regard to many of these services, because of the distinguishing technical characteristics which each of them offer. Furthermore, although the two carrier groups employ independent long-haul facilities across Canada, CN/CP Tel finds it necessary to negotiate for the use of local telephone distribution facilities. However, for most data transmission requests that do not require access to the public telephone network, the two carrier groups consider themselves directly competitive.

At the end of the scale which represents full competition are a variety of telecommunications services that have as their distinguishing feature the lack of reliance on long-haul microwave links or local loop facilities. These include mobile radiotelephone, marine radiotelephone, radio paging and private in-house communications systems. There is substantial competition in many Canadian markets, with a number of non-carrier entrants competing directly with telephone and telegraph companies. These services, when provided by such non-carriers, are unregulated at present, although it is still necessary for them to obtain radio licences from the federal Department of Communications. Significant expansion of services is limited however by their inability to obtain interconnection with carrier distribution facilities except on a dedicated basis. None of these services constitutes a significant element in the computer/communications industry at present.

So far, Canadian regulatory policy has not had to deal with the development of specialized common carriers with independently owned and operated microwave routes, such as that recently authorized in the United States by the Federal Communications Commission in its decision relating to Microwave Communications, Inc.[5] On the other hand, private microwave systems have been authorized by the DOC for remote resource companies, right-of-way companies (hydro, rail, oil and gas), and broadcasting undertakings (studio-transmitter links, re-broadcaster links, CATV system relays). The present over-capacity of the transcontinental microwave systems in Canada and the impending completion of the Telesat Canada satellite system, make it unlikely that additional long-haul microwave competition will develop in the near future, at least on a common carrier basis (although foreseeable reductions in microwave hardware costs may bring increasing pressure for the allowance of private non-carrier intra-city hops).

Local distribution facilities for data transmission continue to be a carrier monopoly in Canada. One possible exception to this is the developing cable television industry which jointly uses carrier poles and ducts for its coaxial cable distribution systems to residential homes. However, restrictions in the present contracts with the telecommunications carriers preclude cable television operators from providing two-way or point-to-point service and this, among other factors, has effectively limited their communications function to the provision of one-way transmission of video channels, which offer programs of either an entertaining or educational nature.

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[5] (1969) 10 F.C.C. 2d 953. See the discussion further below.

2. TELECOMMUNICATIONS REGULATORY AGENCIES

As already noted, the business of transmitting messages for the general public has traditionally been viewed as a public utility in Canada, particularly with respect to public telephone and telegraph service. Accordingly, the carriers identified above are, with only a few exceptions, regulated on such matters as rate of return and service discrimination by independent regulatory bodies, created for this purpose by either the federal or provincial legislatures. The role and jurisdiction of these regulatory agencies is confusing, and in order to facilitate comprehension, a tabular comparison has been prepared in Table 1. As indicated in this table, Bell Canada, B.C. Telephone and CN/CP Tel are at present regulated by a federal tribunal, the Canadian Transport Commission; COTC and Telesat Canada, while unregulated at present, could readily be subjected to CTC review. The remaining 13 telephone systems, all of which are provincially incorporated, are regulated (except for edmonton telephones and Saskatchewan Telecommunications which are self-regulated) by provincial utility boards. There are nine such provincial boards actively involved in telephone regulation at present.

Except for the Ontario Telephone Service Commission, none of the 10 administrative agencies involved in the regulation of telecommunications carriage in Canada is devoted solely to matters of communications. Typically, telephone or telegraph service is dealt with as part of a larger jurisdiction which also embraces such utilities as rail transport and electric power. In some cases, no specific reference to telecommunications as such is made in the enabling statutes, beyond the inclusion of such service within the general definition of public utility. Recently, however, there has been an increased interest shown, at both the federal level and by some of the provinces, in the idea of separating "communications" matters from the rest of utility regulation, in order to permit federal or provincial communications policy to give them separate emphasis and attention. This shift in approach reflects a growing realization that a number of the developing problems in the communications field are specialized and unique, not only with regard to the computer/communications sector but in such areas as educational broadcasting and cable television.

Since 10 administrative agencies are involved in telecommunications carrier regulation in Canada, it is difficult to summarize the nature of government involvement in the review of carrier practices in a brief section. Instead, a variety of distinct regulatory questions — foreign attachments, interconnection, shared use of lines, carrier entry into data processing, and the role of alternative specialized carriers — are singled out for separate discussion in the following pages. It may be useful at this point, however, to set out some of the highlights of telecommunications regulation in Canada, particularly with regard to the review of data communications rates and service offerings. In the notes below, the role of the federal regulatory body, the Canadian Transport Commission, is described in greater detail because of the dominance of Bell Canada, B.C. Telephone and CN/CP Tel in the data communications field. Added notes touch on the role and jurisdiction of the nine provincial regulatory agencies.

The primary focus of the regulatory jurisdiction of the 10 administrative agencies relates to the rates charged by the carriers for public telephone or telegraph service. Each of the agencies regulates the rate of return of the respective carriers under their jurisdiction on the basis of over-all revenues and expenses, rather than distinguishing between rates of return for particular services. The general mode of regulation, called "rate-base regulation", is to limit the total annual allowed revenue of the regulated firm to a sum equal to the sum of the annual operating expenses and a specified percentage of the book value of the invested capital (the "rate-base"). The earnings of each carrier are therefore proportional to the absolute size of the rate-base. Under the present statutes, carriers are typically limited to a "just and reasonable" rate of return, which is generally taken to mean a rate of return comparable to that which the carrier would have been able to obtain had it invested its money in enterprises of a similar nature and risk.[6] Although increased interest has been shown by some of the regulatory commissions in determining the rate of return for individual classes of service, none of the agencies have completed their pending studies on this issue. Until valid cost-allocation studies of this kind are completed, the extent of cross-subsidization, if any, between data and voice service, between various categories of private-line service, or between long-distance and local exchange service, will remain a matter of dispute.

The jurisdiction of the various boards and commissions to review or revise data communications tariffs varies considerably. Since the revisions to the Railway Act in 1970[7] (R.S.C. 1970, c.R-2), the Canadian Transport Commission has had jurisdiction to review and revise all tolls or charges made by Bell Canada, B.C. Telephone or CN/CP Tel "...to the public, or to any person for use or lease of a telephone (or telegraph) system or line, or any part thereof, for the transmission of a message by telephone (or telegraph), for installation and use or lease of any instruments, lines or apparatus attached to, or connected or interconnected in any manner whatever with, a telephone (or telegraph) system, for any services provided by the company through the facilities of a telephone (or telegraph) system, or for any services provided by the company through the facilities of a telephone (or telegraph) business." This clearly embraces all data communications services of any kind, whether or not they are offered to the public, and whether or not they are routed through the public telephone exchange.

The situation with regard to the provincial boards is different.[8] None of the statutes distinguish between "data" and "voice", and in five of the provinces (Alberta, Manitoba, New Brunswick, Prince Edward Island, and Nova Scotia)

[6] *Northwestern Utilities Limited v City of Edmonton* [1929] S C R 186, per Lamont J at 193; *B C Electric Rly Co Ltd v Public Utilities Commission of B C* [1960] S C R 837 For a general discussion of the rate-setting practices of the carriers see the briefs submitted to *Telecommission Study 7(a)(b)*

[7] S C 1969-70 c 20. ss 1 and 2 (Proclaimed in force August 1. 1970)

[8] For more specific details. see Figure 11 and *Telecommission Study 8(a)*: Appendix

the telephone companies are brought under regulatory jurisdiction by virtue of their falling within the definition of a "public utility" — which includes "systems for the transmission of telephone messages, directly or indirectly, to or for the public". Although these statutes then permit the boards to regulate all rates or tariffs charged by the utility, without limiting this to public telephone tariffs, a number of the boards have read such a limitation into the statute and declined to review tariffs that are not charged generally to the public, or, in the case of Nova Scotia, that are not "voice" services. In Ontario, this limitation in jurisdiction is made explicit in the Telephone Act, and the Ontario Telephone Service Commission is confined to reviewing rentals or charges "for supplying telephone exchange service and all services associated therewith". Dedicated data offerings may therefore fall outside the jurisdiction of the Commission in some circumstances. The only real concern expressed by the boards in these six provinces in regard to private-line data communications or other specialized services has been that they should not constitute a burden on the traditional public telephone service. In the remaining provinces where regulatory boards are active (British Columbia, Quebec and Newfoundland), the statutes confer a broad jurisdiction over rates which clearly covers private-line services as well as the public telephone. However, even in these cases, although all tariffs relating to data services are filed for approval, the various boards have not so far made any attempt to segregate the cost or revenues of data communications services in evaluating the over-all rate of return of the companies under their jurisdiction.

All of the administrative agencies have been given a jurisdiction to review and, if necessary, revise tariffs where these are found to be unjustly discriminatory or preferential. As indicated above, some of the agencies involved have read "tariffs" to exclude private-line services, but because of the broad jurisdiction of the Canadian Transport Commission, it can be said that the bulk of data communications services provided in Canada are subject to such review. It is important to note that discriminations or preferences as such are not precluded; these are only made unlawful when they are "unjust", "unreasonable", or "undue". Where services are basically similar, differences in pricing must be justified by either considerations of cost (*i.e.*, direct and indirect burden on the network) or by the existence of a competitive necessity (*i.e.*, where certain customers have a substitute source of supply to which they will shift unless the discrimination is maintained and where the discrimination thus benefits other users by increasing the usage and efficiency of the system). Most complaints regarding discrimination have so far been based on alleged misclassification of users among the public telephone rate classes (*e.g.*, business instead of residential; inclusion of suburban customers within local calling areas); none has been directed towards the definition of the rate classes in general or towards data communications tariffs in particular. The latter area is one of exceptional complexity, because many of the tolls include special charges levied for custom assemblies, and have been largely determined by mutual negotiation. The task of establishing broad classes of data tariffs is even more difficult, because of the conflicting claims of large and small users for rate reductions on the basis of volume of use or different technical characteristics. Recent

regulatory decisions in the United States relating to the TELPAK classifications highlight these issues. The problem is further complicated by the desire of Canadian carriers to implement temporary or conditional rate adjustment in selected areas for the purpose of "market testing". Such rate changes are at present precluded, except where justified by demonstrable cost differentials, and even then lengthy filing and approval procedures are required before they can go into effect.

The jurisdiction of the various agencies over international or interprovincial tariffs is perhaps the most uneven aspect of their mandate. Because the carriers in Canada are accountable to a single regulatory authority only, either federal or provincial, no regulatory supervision is exercised at present by any agency over interprovincial or international rates, save to the extent that the revenue from the domestic portion of such services contributes to a particular carriers's over-all rate of return. (The exceptions to this are with respect to Bell Canada tolls between Ontario and Quebec, and with respect to CN/CP Tel tolls across the country; only the railway consortium at present offers cross-country service by itself.) The existing Canadian facilities for international telecommunications traffic have been described in more detail elsewhere[9] and will only be briefly noted here. In the "continental" system, except for Alaska, international data traffic using the telephone carriers is effected through facilities of TCTS, with various border-crossings provided by a number of member companies operating in provinces with land borders with the United States. Rates are based on the airline distance between designated rate centres, as settled in negotiations between TCTS members and A.T.&T. Canadian-U.S. data traffic using the telegraph carriers is exchanged between CN/CP Tel and Western Union through facilities owned by Western Union in Minneapolis. Again rates are set by negotiation between the carriers providing the services, although the contracts require prior filing with CTC and FCC for approval. In the "overseas" telecommunications system, service is provided to about 200 overseas territories by COTC through international gateway switching-centres in Montreal and Vancouver, accessing both submarine cables and satellite circuits. Some terminal rights have also been granted to foreign-owned international carriers. Data rates for such international services are determined by bilateral agreements between the international carriers and have not been subject to any regulatory supervision in Canada.

The terms and conditions of international or interprovincial data tariffs raise a number of important questions with regard to the Task Force work. First is the disparity between American and Canadian long-distance rates and the possibility of using American long-distance facilities for data communications networks in order to take advantage of cost differentials. A second question is the influence of the terms and conditions of the tariffs on the use of data communications facilities by Canadian customers to access computers in the United States; or in the interprovincial context, where the customers are located in remote areas of Canada, to access computers in urban centres in Canada. Where data communications services are combined with data processing services, the problem of setting appropriate rate structures is made even more difficult.

[9] See *Instant World*, pp 82-87, and *Telecommission Studies 3(a), 3(c), 3(d)* and *3(e)*

The present jurisdiction of the regulatory agencies to deal with these issues is conflicting and inadequate. At the federal level, section 320(11) of the Railway Act (R.S.C. 1970, c.R-2) requires Bell Canada, B.C. Telephone, and CN/CP Tel to file with the Transport Commission for prior approval all "contracts, agreements and arrangements" between the company and any other carriers for the regulation and interchange of communications services, for the division of tolls, or with regard to the management or operation of the interconnecting systems. None of these contracts have in fact been reviewed actively by CTC, and in any case it is debatable whether CTC could alter tolls on a selective basis, or have substantial influence on rates or practices of the interconnecting carriers beyond its immediate jurisdiction. Although CTC has the authority to require B.C. Tel, Bell, or CN/CP Tel to interconnect with other carriers making application to this effect, this power is limited to interconnection between non-competing carriers, and moreover, cannot be ordered save upon the initiation of a carrier not under federal jurisdiction. (The provisions of the Bell Act regarding interconnection are discussed further below.) At the provincial level, all of the agencies[10] except in Nova Scotia and Newfoundland can "order" the carriers under their control to interconnect with outside telephone carriers (although this is frequently restricted to the carriage of "telephone messages"), but again the jurisdiction to review specific point-to-point tolls, or the uses to which the connections are put, is limited and confusing. The lack of a co-ordinated authority over the tariffs and conditions for international and interprovincial data traffic, and over the uses to which customers may put such links, is one of the more pressing jurisdictional issues relating to computer/communications in Canada.

Finally, the regulatory agencies have a variety of ancillary powers over the carriers, some of which touch on the provision of data communications. The Canadian Transport Commission reviews issues of stock or debentures by Bell Canada and B.C. Telephone and, in the case of the latter company, any acquisition of shares or assets of companies with similar objects. The Bell Act also contains a limited provision obligating Bell Canada to furnish "telephone service" to those tendering the applicable rates within areas in which a general service is given.[11] It may be argued that this does not extend to specialized data communications equipment or services. No powers are given to CTC over "adequacy of service", or to approve major capital expenditures prior to their being incurred. CTC's sole authority over such matters is its power to disallow excessive expenditures when reviewing the company's rate of return, and the Commission has many times reiterated its philosophy that "its powers are regulative and corrective, and that they are not managerial."[12]

[10] In Saskatchewan and New Brunswick, the power to require interconnection with outside telephone companies must be exercised by the provincial cabinet

[11] *Bell Canada Act*, S C 1880, c 67, as amended by S C 1902, c 41, s 2 See also *Metcalfe Telephone Ltd* v *McKenna* and *Bell Telephone Company of Canada*, [1964] 76 S C R 202

[12] *Review respecting the Bell Telephone Co of Canada* (1966), 56 J O R R 535 at 718; *Review Respecting the British Columbia Telephone Co* (1966), 56 J O R R 369 at 517-518 See, to the same effect, *Tinkess* v *Bell Telephone Co* (1916), 20 C R C 249; *Point Grey* v *B C Telephone Co* (1928), 34 C R C 175; *York* v *Bell Telephone Co* (1928), 34 C R C 170; *Bell Telephone Co* v *Cities of Toronto, Montreal, Ottawa, et al* (1950), 40 J O R R 314

At the provincial level, considerably more authority is given to the public utility boards with regard to such matters as adequacy of service and construction expenditures, although again this is frequently limited to expenditures relating to the provision of public telephone service. The precise details of these ancillary powers are provided with respect to each provincial utility board in the Appendix, to which reference should be made. In particular, the powers of the Quebec Public Service Board and the Ontario Telephone Service Commission are substantial in the areas of adequacy of service, extension of service or systems, and accounting practices.

3. FOREIGN ATTACHMENTS

One of the contentious issues in the data communications field is the extent to which communications customers may be permitted to attach non-carrier provided devices directly to the telephone network. Traditionally, the telecommunications carriers have emphasized that they provide a telecommunications "service" rather than simply communications facilities. Consequently, they have usually insisted on providing end-to-end communications capacity through carrier owned and controlled equipment at each stage of the communications process. Customer owned terminal equipment, usually referred to as "foreign attachments", have normally been prohibited or severely restricted by carrier tariffs; in some cases, provincial legislation further limits their use. Such restrictions have been variously defended on the grounds of the need for system integrity, which might be jeopardized by excessive signal levels or interference with the automatic switching, signalling and charging equipment; by the problems created by the divided responsibility for operational standards and maintenance; and by the need to protect the carriers' freedom to innovate and introduce network improvements. The basic regulatory question is whether these restrictions, which arguably add to both cost and inconvenience to certain users, extend the carrier monopoly past what is reasonably necessary to prevent harm to the network.

The issue of foreign attachments is particularly topical in light of the recent liberalization of A.T.&T. tariffs in the United States, impelled by the decision of the Federal Communication Commission in the *Caterfone* case.[13] Since this decision, revised tariffs filed by A.T.&T. have allowed customers for the first time to attach their own equipment to the switched telephone network, subject to three basic restrictions which are still the subject of controversy; first, such equipment must limit power output and distribution according to certain guide-lines; second, electrical (as opposed to acoustic) coupling must be done through an appropriate carrier-provided protective interface device, and third, only A.T.&T., supplied network-control signalling units may be used.

[13] *In the Matter of Use of the Carterfone Device in Message Toll Telephone Service* (1968) 13 F.C.C. 2d 420

It is appropriate here to examine the jurisdiction of the Canadian regulatory agencies to rule on such questions, or even to consider complaints touching on this issue. At present, the jurisdiction of the various agencies to rule on foreign attachment policy is ill-defined and, in most cases, ineffective. At the federal level, the Railway Act gives no general powers to the Canadian Tranport Commission with respect to foreign attachments, except to the extent that provisions prohibiting such attachments could be considered discriminatory. However, the Bell Canada Act, as amended in 1968[14] provides that any equipment, apparatus, line, circuit or device not provided by Bell Canada may only be connected or attached to or used in connection with the facilities of Bell in conformity with ''reasonable requirements as may be prescribed by the Company''. The Transport Commission is given the power to determine whether or not such requirements of Bell are reasonable and may disallow such requirements if it considers them unreasonable or contrary to the public interest. It should be added however that the position of Bell Canada under this legislation is by no means clear and recent litigation[15] has raised the issue of whether or not Bell is required to prescribe any reasonable requirements at all.

At the provincial level, the situation is straight-forward. No provincial agency in Canada has the power to require foreign attachments to be connected to the utilities under its jurisdiction. On the contrary, a number of the statutes specifically prescribe that no foreign attachments shall be permitted without the permission of the particular utility, and some include penalties for such connection. Details with respect to these restrictions are contained in the Appendix.

4. INTERCONNECTION

An issue which is directly related to the foreign attachment question is the problem of determining when interconnection should be effected between the telecommunications carriers' networks and between their networks and private communication systems owned and maintained by customers. The interconnection issues cannot be described in simple terms; there are many different types of interconnection problems, each with different economic effects and different technical parameters to be considered. The regulatory questions involved are complex, and range from problems of technical interference or incompatibility to allegations of economic ''cream-skimming'' and interference with the rate-averaging concept.

Of interest here is the present jurisdiction of the Canadian regulatory agencies to examine these questions and rule on whether or not carriers should grant or deny interconnection. As with the foreign attachment issue, the provisions

[14] SC 1880 c 67 as amended by SC 1948 c 81 and SC 1967-68. c 48 s 6

[15] See *EJ Piggott Enterprises Ltd., carrying on business as Perception Industries Inc v Bell Canada* (Ontario High Court adjourned upon consent pending consideration by Canadian Transport Commission Nov 24 1971); *Canadian Cable Television Assn et al v Bell Canada* (complaint filed with Canadian Transport Commission January 1972)

in the present statutes are both ill-defined and inadequate. Although many of the statutes allow the regulatory agency to order interconnection between the telephone systems under its jurisdiction and other utilities, a similar power does not exist with respect to interconnection between the carrier system and communications systems of non-utility customers. At the federal level, the revisions to the Bell Act referred to in the earlier section on foreign attachments do provide the Canadian Transport Commission with an arguable jurisdiction to require Bell to interconnect with other communications systems, subject to reasonable requirements to be arbitrated by the Commission, but this is by no means clear and is still the subject of controversy.

Under the provincial statutes, the jurisdiction of the provincial utility boards in Canada to deal with interconnection problems is, as noted above, inadequate except for interconnection between utilities. In one or two provinces, the boards are given the authority to order the telephone systems under their jurisdiction to "provide service", but it is questionable whether this applies to anything more than traditional public telephone service and would afford little assistance to private data communications network operators seeking to interconnect with the public switched-network, or other private networks which also make use of carrier facilities.

5. LINE-SHARING AND RE-SALE

One of the developing regulatory issues is the extent to which the carriers should be required to permit line-sharing or re-sale. Line-sharing, as the term implies, involves the shared use of a communications channel or group of channels by more than one user. Such usage makes possible the re-sale for profit of line capacity freed by sharing. Data communications users favour sharing, because it allows communications costs to be reduced by avoiding the need to buy more communications capacity than is required. The regulatory issues are particularly complex, because the freedom for users to derive their own subchannels also raises the possibility of the eventual entry by non-carriers into message-switching services, and this again raises difficult questions with regard to pricing and competition.

Among the regulatory issues to be considered is the possibility of cross-subsidization between regulated carrier services and data processing services, the question of preferential or discriminatory treatment, the impact of the economies of scale available to the carriers on regional and national competition and the effect of carrier entry on Canadian ownership and control. These issues are discussed in more depth in Telecommission Study 5(a),(c),(d),(e), and in Chapter IX, Volume I. The present status of the TELPAK case in the United States illustrates the basic inadequacy of the regulatory agencies to deal with some of the economic questions raised by the suggestion that lines be shared or re-sold.[16] In Canada, the regulatory agencies can only review or revise tariffs containing restrictions against line-sharing or wholesaling where these tariffs are excessive, inadequate, or

[16] (1970), 23 FCC 2d 606

unjustly discriminatory. Since it has been the practice of the carriers to apply a prohibition of re-sale across the board, it cannot be said that their tariffs relating to this question are discriminatory. Given the fact that the regulatory agencies in Canada have little or no power to require the filing of new classifications of tariffs, it does not appear that the question of line-sharing or re-sale can be dealt with by these agencies until the carriers decide of their own volition to liberalize the present restrictions, or substantive amendments are made to the statutes creating the respective agencies.

6. CARRIER-ENTRY INTO DATA PROCESSING

One of the most critical questions in computer communications policy is the extent to which the telecommunications carriers should be permitted to enter into the data processing field.

In the United States, rules have recently been enacted by the FCC permitting carriers into commercial data processing only on condition that "complete separation" between the carriers and their data processing affiliates be maintained, including a prohibition of the sale of EDP services by the affiliate to their related carriers.[17] A.T.&T. and its affiliated companies are in any case precluded by a 1956 consent judgment from engaging in any other business than "the furnishing of regulated common carrier services", which effectively prevents them from offering data processing services. In Canada, the 1968 amendments to the Bell Canada Act stipulate that the Company shall "act solely as a common carrier, and shall neither control the contents nor influence the meaning or purpose of the message emitted, transmitted or received...." Although it is unlikely that this restriction applies to Bell-related companies, it may operate as a significant inhibition to the provision of data processing services by Bell Canada itself.

What is the jurisdiction of the regulatory agencies in Canada to impose guidelines similar to those adopted by the FCC, or in fact to implement policy decisions with respect to this area at all? At present, the ability of the Canadian agencies involved to deal with these questions is quite inadequate. As outlined in the Appendix, some of the provincial utility boards have the jurisdiction to approve the acquisition or sale of parts of the undertaking of the telephone carriers within their jurisdiction. At the federal level, CTC approval is required if B.C. Telephone desires to acquire the shares or assets of companies with similar objects. But except for these restraints, little or no jurisdiction resides in the present administrative agencies to rule on the question of entry by the telecommunications carriers into the data processing field. Whether such entry is accomplished by the setting up of a separate corporate subsidiary, or through the organization of a separate operating division of the telephone company, no general regulatory review exists at present in Canada with respect to the issues of competition policy noted above. Moreover, the lack of involvement of the existing agencies with cross-subsidization problems to date does not augur well for their capacity to deal even with such questions as the burden which may be imposed upon the public telephone service by carrier entry into data processing.

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[17] *Regulatory and Policy Problems Presented by the Interdependence of Computer and Communications Services and Facilities*. Docket 16979, F.C.C. 70-338 (Released April 3, 1970)

7 ALTERNATIVE SPECIAL CARRIERS

A final regulatory question relating to data communications in Canada is the extent to which government policy allows or precludes the development of specialized common carriers, offering transmission facilities to computer/communications customers. This issue has surfaced a number of times before the FCC in the United States,[18] and it may be useful to discuss the present legal and regulatory constraints upon diverging or similar policies in the Canadian context. In examining the existing legal framework, however, one is confronted with an interesting anomaly in Canadian telecommunications utility regulation. In the United States, no telecommunications common carrier may construct lines or commence business without first obtaining a certificate of "public convenience and necessity" from the appropriate regulatory agency which may grant or deny it on the basis of hearings at which all affected interests can be heard. In Canada, except in limited contexts, no such requirement exists.

If radio frequency spectrum space is needed, the firm must of course obtain a licence from the federal Department of Communications, and this may operate as a considerable constraint in areas where spectrum space is crowded, or where alternative service is available from existing carriers. Organizations seeking to offer transmission and distribution facilities based on wire or cable links, however, are the present outside federal jurisdiction, except where such links connect one province with another or extend across provincial or international boundaries. In such cases, the sole legal restriction on the ability of would-be common carriers to enter the field of telecommunications using cable or wire is the necessity of obtaining a corporate charter with such powers. Because of this legal hiatus, it is fair to say that the most significant restraint on the development of specialized common carriers is the myriad of economic and financial barriers to their entry. This is particularly true in the case of local loop distribution, for it is largely impractical on both an economic and political basis, because of the need for municipal easements, for would-be carriers to develop their own distribution facilities.

The lack of a unified regulatory practice in Canada requiring the issuance of a certificate of public convenience or necessity has led to the result that franchising requirements are sporadic, uneven, and in many cases, nonexistent. Since part of the Task Force mandate was to examine the need for specialized data communication networks in Canada, and to canvass the legal or regulatory constraints or incentives for these developments, the lack of a clear jurisdiction at any regulatory level to deal with these issues constitutes one of the more obvious institutional problems recognized in this Report.

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[18] See *Microwave Communications Inc.* (1969) 18 F.C.C. 2d 953 and *Specialized Common Carrier Services* (1971) 29 F.C.C. 2d 870

Chapter II
Legal and Regulatory Aspects of Data Processing

1. PRESENT LEGISLATION

As noted in the introduction to this Report, the data processing industry in Canada has evolved in an entirely different legal framework from that applicable to the telecommunications carriers. While the carriers have been viewed as utilities and made subject to substantial government regulation, the data processing service industry has been characterized by intense competition in a variety of areas and little if any direct government regulation or involvement. (Note that in the discussion below, the concentration is placed upon the data processing service industry, rather than such sectors as mainframe manufacturing.) The legal environment for data processing services has reflected the number of entrants in the industry, the specialization of a number of these firms, and the rapid pace of technical and economic change that has characterized industry-growth.

What is this legal environment? At present the only legislation directly affecting the development and rationalization of the data processing industry relates to such matters as criminal law and restraint of trade. The discussion which follows therefore relates more to legal questions arising out of the relationship between entrants in the data processing field (*e.g.*, competition policy, private contractual rights) than to legal questions arising out of the role of government as regulator. In the following sections, brief comments are addressed to the ambit of the present competition legislation, the effect of the proposed new competition legislation, the computer and the law of privacy, the question of tort liability for computer misuse, and, finally, the protection of computer software.

Competition policy in the data processing industry is governed at present by the terms of the Combines Investigation Act (R.S.C. 1970, c.C-23). Although the Act applies only to articles and not to services its provisions nevertheless have wide applicability to marketing practices in the data processing industry. The Act makes it an indictable offence to conspire, combine or agree to (1) limit unduly the facilities for transporting, producing, manufacturing, supplying, storing, or dealing in any article; (2) restrain or injure trade or commerce in any article; (3) prevent, limit or lessen, unduly, the manufacture or production of any article or enhance unreasonably the price thereof; or (4) prevent or lessen, unduly, competition. These provisions relating to unlawful combinations, to the extent that they touch upon the provision of computer peripheral equipment, data terminals or the rental thereof, software when reduced to physical form, or similar matters, may affect in considerable degree the capacity of entrants in the data processing industry to compete unfairly or to combine for the purpose of restricting competition.

Other sections of the Act make it an indictable offence for persons to engage in certain discriminatory trade practices. Among other things, for example, it is made an indictable offence for any person to be a party to any sale that discriminates to his knowledge, directly or indirectly, against competitors of the purchaser in that any discount, rebate, allowance, price concession or other advantage, is granted to the purchaser over any such advantage available at the time of the sale to such competitors. Again, it is an offence to engage

in a policy of selling goods in any area of Canada at prices lower than those charged elsewhere by the seller, having, or designed to have, the effect of substantially lessening competition or eliminating a competitor in such part of Canada. It is further made an offence to engage in a policy of selling goods at prices unreasonably low, having, or designed to have, the effect of substantially lessening competition or eliminating a competitor. The ambit of the offence is limited, in that the act must be part of a policy of discrimination, but a number of possible practices in the data processing industry, where these relate to the supply or rental of articles, are touched by these sections.

The Act also restrains to some extent monopolistic practices, although these provisions have been severely truncated by court decisions. It is made an indictable offence, however, for any person to be party or privy to, or knowingly assist in, or in the formation of, a merger or monopoly. It is also made an indictable offence to participate in re-sale price maintenance agreements, or acts done by dealers in furtherance of re-sale price maintenance. Further sections in the Act provide that customs duties may be reduced, or removed from any imported article where these duties have facilitated the operation of a combine at the expense of the public. In addition, patents or trade-marks may be declared void in whole or part where they are used to restrain or injure trade or commerce, or to unduly restrict competition. Under the Act, injunctions may be obtained to restrain anyone convicted of one of the above-mentioned offences from continuing or repeating the offence, or performing any act directed toward such continuation or repetition, and an order may be obtained directing the dissolution of any merger, trust or monopoly.

One of the difficult questions in antitrust law in Canada is the extent to which it applies to regulated industries. Where legislation relating to selected industries specifically promotes or sanctions trade practices which are prohibited by the Combines Investigation Act, the cases indicate that this may constitute a defence under the latter act. The Director of Investigation and Research for the Combines Investigation Branch has commented, relating to the present state of confusion in administrative responsibility, as follows: "The telecommunications industry is an example of an industry which is in part subject to the regulation by a government agency, in part subject to the Combines Investigation Act, and in part subject to neither of these forms of control."[19] While the manufacture and sale of communication equipment, data processing equipment, and peripheral devices, is subject to the Act, the provision of many communication services, to the extent that they are not dealt with by the administrative agencies regulating the utilities providing them, may also be exempt from any other regulation relating to competitive practices. Service bureau facilities, using remote links, are therefore in a confusing middle area of the law, relatively untouched by the present jurisdiction of the regulatory agencies, and in many respects outside the purview of the Combines Investigation Act.

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[19] Evidence of D. Henry, Q.C. before the House of Commons Standing Committee on Transport and Communications *Minutes of Proceedings and Evidence*, December 7, 1969, p. 386

2. THE PROPOSED NEW COMPETITION ACT

Following the release of the Interim Report of the Economic Council of Canada on Competition Policy (July 1969), suggested new legislation to replace the present Combines Investigation Act was placed before Parliament in the summer of 1971. Although, at the time of writing, Bill C-256 (The Competition Ac is undergoing revision, and the Bill is expected to be reintroduced in altered form in the next session, it may be appropriate to comment in a general way on the impact of the basic changes that Bill C-256 represents to the data processing industry.

The most significant change made by the proposed Competition Act is that services are included along with commodities in all relevant contexts. The new Act would therefore embrace software supply houses, service bureaux, applications services consultants, and other service sectors of the data processing industry, whether or not such services are associated with physical commodities or articles. Other departures in the proposed legislation include the creation of a Competitive Practices Tribunal to administer a number of civil law provisions introduced in the Act for the first time, and more detailed descriptions of prohibited trade practices. The Tribunal would be given the authority to rule on the acceptability of mergers, export and specialization agreements, franchise arrangements and other trade practices, subject to detailed criteria for exemption. Penalties for non-compliance would be increased, and would include provision for the award of double damages to parties injured by those convicted of prohibited offences.

Under the draft legislation, a wide variety of trade practices would be reviewable, including price discrimination, tied sales, directed selling, exclusive dealing, delivered pricing, and refusal to deal, some of which have been the subject of specific complaints to the Task Force. The language employed in the proposed Act is complex, and with regard to each of these practices, criteria for specific exemptions are set out in detail. Since the actual wording of the prohibitions and exemptions is currently undergoing revision it may be premature to elaborate on the likely effects of the legislation in particular cases. Nevertheless, the ambit of many of the sections is so broad, it is possible that their effect might prevent or impede certain practices which might be in the best interests of increased competition. One example is the development of computer services consortia. In a typical case, two or more companies (which may or may not themselves be competitive) may jointly agree to combine their in-house data processing facilities into a separate commercial organization for the purpose of obtaining access to a larger computer on an assured basis for developing specialized programming, and for economies of scale. This is a particularly effective means for Canadian industry to achieve cost-savings which are available in the ordinary course of events to the larger U.S. companies. Under the initial draft of the competition legislation, however, it is debatable whether such an arrangement would be permissible. Similar problems might occur with regard to the formation of industry-wide committees to set up detailed technical specifications to be adopted by data communications or data processing suppliers. Whether or not,

for example, technical or economic criteria adopted by the industry for network interconnection would fall within the exemption given for agreements on "product standards" remains a difficult question.

The relationship of the proposed Act to regulated sectors of the computer/communications industry is set out in section 92 of Bill C-256. The Act is declared to be inapplicable to agreements or "courses of conduct" where the persons involved "are expressly required or authorized to do so by an enactment" of the federal or provincial legislatures or by any regulation, order, rule or other instrument made pursuant to such an enactment, and the arrangement or course of conduct "is expressly required to be supervised and regulated, on a continuing basis, by a board, commission or other public body appointed... pursuant to such enactment and that is charged with the duty of protecting the public interest." It is clear from this section that the Act applies to the telecommunications carriers with respect to all rates, agreements and practices that are not specifically sanctioned by a regulatory board expressly authorized to supervise or regulate such practices. Given the limitations of the present jurisdiction of the CTC and the various provincial utility boards to review many carrier activities (as noted in the earlier discussion), the Act would appear to have wide applicability to many of the issues of competition policy involving the carriers which are dealt with in this Report. In this respect, the relationship between the new competition legislation, and the statutes relating to communications utility regulation in Canada, would not be unlike the relationship in the United States between the administration of S.2 of the Sherman Act and S.7 of the Clayton Act by the Department of Justice Antitrust Division, and the administration of the Communications Act by the Federal Communications Commission: each would have their role to play, but each would also need to take into account the statutory policies sought to be implemented by the other agency.

3. COMPUTERS AND PRIVACY

Although the bulk of this Report has focussed on what may be termed the public or regulatory aspects of computer/communications, a variety of private law issues remain to be considered. One of these is the impact of computers and communications systems upon the privacy of Canadian individuals. Early in the work of the Task Force it was realized that this issue was so important and complex that it deserved separate study and attention. Accordingly, a separate task force was formed under the joint sponsorship of the Department of Communications and the Department of Justice, to study and report independently on the question of computers and privacy.

A list of issues relating to computers and privacy of the individual is contained in the terms of reference of that task force:

"In general, to consider privacy and the issues raised by possible invasions of privacy through the collection, storage, processing and the use of data contained in automated information and filing systems. And in particular:

- To examine the types of personal information collected for, stored in, proceeded by and distributed by automated information systems, both private and public, today and in the future;
- to examine, in terms of their implications for privacy and dignity and related values, the procedures and mechanisms for the collection, storage, processing and distribution of personal data in automated information systems;
- to examine and evaluate security procedures and mechanisms employed to prevent unauthorized access to automated information systems;
- to examine and evaluate possible measures, whether juridical, regulatory, technical or professional which might ensure reasonable protection of the privacy of persons about whom information is maintained in automated files, and to evaluate potential constraints whether commercial, legal, or constitutional, against the application of these measures."

The role of the law in privacy problems is still in a rudimentary stage of development. The often used quotation "a man's home is his castle" is attributed to Sir Edward Coke, who voiced the sentiment in the seventeenth century. This principle reflects a British tradition of architectural or spatial privacy which has been supported by the common law in a variety of ways. The issue of information privacy, or the treatment of personal information, is different from that of spatial privacy in several respects, the most obvious being that, while two people cannot possess or occupy the same space, two people can possess the same information without it being altered in any way.

The rights of an individual with respect to information about himself have not thus far been defined in Canadian or English law, though the concept of a "right of privacy" has developed a considerable literature in the United States. Bills recently enacted in the B.C. and Manitoba legislatures are aimed primarily at providing some protection from abuses by investigative and credit reporting agencies. The privacy law in British Columbia requires no proof of damage in order that action be brought. A number of bills specifically concerned with data banks and privacy have also been introduced by private members in other provinces and in the federal Parliament, although these have not been acted upon to date. There is of course protection afforded by the common law for a number of situations related to privacy, such as libel, slander, breach of confidentiality (generally applicable to lawyers, physicians, bankers, employees and spouses) and negligent mis-statements.

In Quebec, some protection of privacy has been afforded under the aegis of Article 1053 of the Civil Code, a general provision which states that "every person capable of distinguishing between right and wrong is responsible for damage caused to another by his fault, whether by his acts, his carelessness, his negligence or his incompetence."

Brandeis has described privacy as "the right to be left alone". In terms of information (as opposed to spatial) privacy, a strict definition would describe a state in which no information is demanded or given. Thus, strictly speaking, a study of informational privacy would concern itself only with information accretion or collection. In practice, normal usage extends the definition to considerations of confidentiality (or how the data are handled, once collected), data accuracy and rights of access, rights to change or amend content of file and control distribution, and security (or the degree of protection given the data). Because it is expected that the Report of the Privacy and Computers

Task Force will be available in the near future, no further discussion of these issues is set out in this Report.

4. DATA PROCESSING AND PROBLEMS OF LIABILITY

A related question that has given some reason for concern is the adequacy of contractual or tort remedies in the event that computers are misused, or where computer users are misled as to the effectiveness of a computer system and suffer damage when it fails to meet the promised specifications. Although very few cases have reached the courts involving damage caused by computer systems, the possibility of harm arising through the use of such systems has become progressively greater as the computer has become both more sophisticated and more pervasive. Many examples of the potential for damage have been suggested:

"An explosion causing expensive damage to persons and property occurs in a chemical plant controlled by a computer. A commercial bank using an electronic check-processing and bookkeeping system incorrectly refuses to pay a check drawn by a business customer, who consequently loses a potentially profitable transaction. Computer malfunction in a business management system injures a customer's credit. A railroad classifying its freight cars by computer control erroneously designates a car containing fragile merchandise for rough handling and thereby damages the car's contents. A mistake by the railroad computer...causes loss of a customer's car and costly nondelivery of needed raw materials. Relying on a computer to calculate steel girder specifications for a skyscraper, an engineering firm inadvertently misses an error and the building collapses during construction. A rapid transit district uses a central computer; it malfunctions and several trains pile into each other. Through a data processing error, a private hospital releases a patient infected with a contagious disease and he passes that disease on to others."[20]

The resolution of these problems, were they to arise, would take place within the existing legal framework of contractual and tortious remedies, since no special branch of the law deals specifically with data processing. Depending on the fact situations, and on the terms of the warranties contained in the relevant leasing or other contracts, liability might be traced back to computer manufacturers, owners, lessees, users, operators, consultants or programmers for what their computers do or fail to do. Although it is doubtful whether these parties are prepared at present to deal with such claims, most of them are becoming increasingly aware of the potential for liability. It is likely that the problem of liability for computer use or misuse will become increasingly critical as the new technology develops.

5. THE PROTECTION OF COMPUTER SOFTWARE

A further question that has received increased attention from lawyers acting for firms involved in data processing relates to the protection of computer programs and software from misappropriation. Although this problem has been more closely studied in the United States and the United Kingdom, it has recently surfaced in Canada through the activities of the Economic Council and the Canadian Patent Office. The basic question is whether or not the product of commercial software sellers should be protected from unpaid appropriation through one of the statutory forms of protection (patent,

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20 Brown, "The Computer and the Law of Torts," ch. 3 in *The Law of Computers* (Ann Arbor: Institute of Continuing Legal Education, 1971) at p. 46.

copyright or whether such vendors should be obliged to rely, where they find it necessary and feasible, on contractual clauses in their lease or sale contracts, or on confidentiality and trade-secret protection. Because of the inadequacies of the latter forms of protection, and the inadequacies of copyright law, there has been considerable pressure from software houses for a recognition of the inventive process in software creation by allowing computer programs to be patentable.

The position in other countries is mixed. Up to 1969 in the United States, computer programs were denied patent protection, following the recommendation of the President's Commission on the Patent System,[21] on the basis that a series of commands in program language were purely mental steps. Since then however three court cases[22] have overruled the Patent Office's stand and allowed patents on programs. In the United Kingdom, following a decision of the British Patent Office in 1966,[23] guide-lines were issued in 1969 which allow patent applications for computer programs to be approved, subject to their being framed within the limitations as to form contained in the British legislation.[24]

The position in Canada has just recently changed so as to allow patent protection along the lines permitted in the United Kingdom. Up to late 1971, patent protection for computer software was precluded by a guide-line issued by the Commissioner of Patents,[25] and this ruling was supported by the Economic Council in its Report on Intellectual and Industrial Property.[26] Since that time, however, the Commissioner of Patents has ruled that, although claims to a computer program *per se* are not patentable, claims to a new and novel method for controlling a machine (*i.e.*, a process for conditioning the operation of a data processor) are patentable.[27] This essentially parallels the English position, which denies patents to computer programs or algorithms alone, but permits them where claims are framed to embrace the use of a computer by controlling it or operating it, according to an algorithm, in a certain new and novel way.

21 *Report of the President's Commission on the Patent System* (Washington, U.S. Government Printing Office, 17 November 1966)

22 *In re Prater and Wei* (1969), 162 U.S.P.Q. 541; *In re Mahoney* (1970), 164 U.S.P.Q. 572; *In re Musgrave* (1970), 167 U.S.P.Q. 280

23 *Slee and Harris's Application*, [1966] R.P.C. 194

24 *Official Patents Journal* (U.K.), 5 March 1969, p. 683

25 Notice of the Commissioner of Patents (Canada), July 1970

26 Economic Council of Canada, *Report on Intellectual and Industrial Property* (Ottawa, Information Canada, March 1971), pp. 101-104

27 *Official Patents Journal* (Canada), January, 1972

Chapter III
Constitutional Considerations

This chapter is concerned with the issue of the constitutionality of present or proposed federal or provincial legislation affecting the computer/communications industry. Most of the problems addressed in this Report have important repercussions on a local or regional, as well as on a national, basis. With this in mind, the Task Force has been conscious of the need to establish as clearly as possible the respective roles of the provincial and federal governments at both the constitutional and administrative level.

What level of government, provincial or federal, has jurisdiction in any given case to legislate, or create new administrative frameworks affecting computer/communications? It is not an overstatement to say that this issue has constituted one of the most sensitive and difficult problems dealt with by the Task Force. On many of the most fundamental questions, no common agreement exists. The task of the constitutional lawyer is rendered more difficult by the fact that the activities and social interests affected by computer/communications touch almost every sector of industry and society, and effectively cut across many of the traditional jurisdictional boundaries. Again, many of the questions that can be posed have received little if any direct judicial attention in Canadian courts, and it is therefore necessary to consider a wide variety of judicial precedents from analogous fields. These precedents, depending on their limitations and ambiguities, may or may not be persuasive in determining the results where the computer/communications industry is involved.

It is also important to distinguish between the prediction of court decisions, *i.e.*, the determination of whether the present Canadian courts would uphold suggested legislation as *intra vires*, and the more sensitive question of the optimum distribution of legislative powers on political or administrative grounds. This section deals primarily with the former question--namely, the extent to which the provisions of the Canadian constitution relating to the division of legislative powers affect the jurisdiction of the federal and provincial governments over computer/communications. In areas where the present constitutional framework leads to unworkable or impractical divisions of legislative responsibility, however, there will inevitably develop a need for the various levels of government to work out more effective administrative arrangements on a co-operative basis, in the light of each government's perceived needs and concerns.

This process involves many more considerations than just computer/communications, and the recommendations of the Task Force; such co-operation will undoubtedly need to take place in the wider context of communications policy as a whole. With this in mind, it is important to realize that the comments relating to intergovernmental co-operation and adjustment that appear are not based on an over-all review of communications policy, but are limited to the narrower issues presented by the computer/communications industry. Despite this limitation, comments are made upon jurisdictional shortcomings, where these appear to touch directly on the issues confronting federal or provincial government policy-makers with regard to this industry.

Keeping these preliminary observations in mind, it is now appropriate to examine the present constitutional framework for computer/communications, in the light of the terms of the *British North America Act* and the decided cases. Not surprisingly, the B.N.A. Act of 1867 makes no explicit references to either ''computers' or ''communications'; the only direct reference to telecommunications, as now defined, is the use of the word 'telegraphs'' in section 92 (10) (a). The disposition for constitutional purposes of areas such as electronic data processing where technology has created entirely new vocabularies, is made on the basis of the general wording found in Sections 91 and 92. Although the reader is referred elsewhere for a fuller treatment of the basic principles of Canadian constitutional law,[28] it may be useful to summarize the elements of the constitutional framework that touch directly or indirectly on computers and communications systems.

One may begin by observing that there is no inherent constitutional value in either of the terms ''computer' or ''communications''. The determination of constitutional jurisdiction rests on a variety of factors, ranging from the nature and purpose of the particular legislation, to the nature and purpose of the business or operation sought to be regulated. In each case, the functional and territorial attributes of the computer/communications system must be carefully examined, along with such matters as the type and location of the customers, the kind of remote links employed (if any), and the nature and intent of the particular legislation.

The most useful starting point for an analysis of the basic regulatory authority over computer/communications systems is paragraph 92(10) of the B.N.A. Act. This paragraph confers exclusive jurisdiction over ''local works and undertakings'' to the provinces, subject to certain exceptions which are assigned exclusively to the Dominion Parliament through the operation of paragraph 91(29). The exceptions of interest are s.92(10)(a): ''...Telegraphs, and other Works and Undertakings connecting the Province with any other or others of the Provinces, or extending beyond the limits of the Province''; and s. 92(10)(c): ''Such works as, although wholly situate within the Province, are before or after their execution declared by the Parliament of Canada to be for the general Advantage of Canada or for the Advantage of Two or More of the Provinces.'' The basic question that must therefore be asked with respect to any particular computer/communications system, service, or enterprise is whether or not the system can properly be characterized as an interprovincial work or undertaking, within the meaning of s.92(10)(a), or whether it is the subject of a declaration under s.92(10)(c). If either is the case, the system will be exclusively within federal jurisdiction. If not, and the system can properly be characterized as a ''local work or undertaking'' (which also assumes that the system lacks such dimensions of national importance as to attract federal jurisdiction under the residual power), the provinces will have exclusive authority to pass legislation with respect to such systems.

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28 For general treaments see *Instant World*, pp 205-211, *Telecommission Study* 1(a), and Laskin, *Canadian Constitutional Law* 3rd ed rev (Toronto, Carswell, 1969) More specialized background can be found in McNairn Transportation, Communication and the Constitution: The Scope of Federal Jurisdiction' (1969) 47 *Can Bar Rev* 355; Grant Constitutional Jurisdiction and the Radio Frequency Spectrum.'' Chapter 2 in *Canadian Broadcasting Law and Administration* (Toronto, CCH Canadian, forthcoming); and Lederman, ''Telecommunications and the Federal Constitution of Canada'', in *Telecommunications in Canada* (Toronto, Methuen, forthcoming)

The declaratory power under s.92(10)(c) may be dealt with briefly. Since 1867, this power has been exercised some 470 times with regard to a wide variety of works.[29] In the computer/communications field, the only significant declarations have been in the special Acts constituting Bell Canada and British Columbia Telephone Company.[30] All the works of these companies have been declared to be for the general advantage of Canada and consequently their data communications and data processing operations come exclusively under federal jurisdiction, whether or not they are "interprovincial" in character. Although the point has never been expressly determined, it does not appear that these declarations apply to data communications, or data processing operations of wholly-owned or partly-owned subsidiaries of Bell Canada or B.C. Telephone (e.g., Newfoundland Tel or Okanagan Tel). Such operations would need to fall within the terms of s.92(10)(a), *e.g.*, by constituting an interprovincial undertaking, or being closely integrated with such an undertaking, to be clearly within federal jurisdiction.[31] It should also be added that the last exercise of the federal power under s.92(10)(c) occurred in 1961, and its use as a unilateral device for obtaining regulatory jurisdiction has been largely abandoned in sensitive or controversial areas. In consequence, the Task Force has not considered the possibility of the future use of s.92(10)(c) for constitutional purposes in the computer/communications field. Instead, where valid areas of federal concern exist, the Report focuses on the use of the existing constitutional powers, combined, where necessary, with intergovernment co-operation and mutual adjustment.

The problem of determining when a computer/communications work or undertaking falls within the meaning of s.92(10)(a) is more difficult, but the basic principles can be briefly summarized. To begin with, it appears clear that persons in the business of offering computer services through the use of a stand-alone computer, operated on an over-the-counter basis at one or more locations, would *prima facie* be subject to exclusive provincial jurisdiction. Such computers, and the services involved, would probably constitute local works or undertakings within the meaning of s.92(10), save where they were declared works under s.92(10)(c) (as for example those of Bell Canada or B.C. Tel), or works operated as integral parts or businesses otherwise subject to exclusive federal jurisdiction (*e.g.*, chartered banks, airlines, or federal government operating agencies). This would probably apply even if many of the customers of the over-the-counter service brought their work in from outside the province concerned.

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29 See generally Laskin, *supra* at 504; MacDonald, "Parliamentary Jurisdiction by Declaration", 1 D L R 1; Schwartz "Fiat by Declaration — s 92(10)(c) of the British North America Act" (1960), 2 *Osgoode Hall* L.J 1; Hanssen, "The Federal Declaratory Power under the British North American Act" (1968) 3 *Man. L.J.* 87; and Lajoie, *Le Pouvoir Declaratoire du Parlement* (Montréal, Les Presses de l'Université de Montréal, 1969)

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30 Section 6 of the *Railway Act*, R S C 1970, c R-2, also declares that the railways and connected works of CNR and CPR are works for the general advantage of Canada, but this would not appear to operate as an effective declaration with respect to their independent communications operations: see *C.P.R.* v *A.-G B.C.*, [1950] 1 D L R 721, [1959] A C 122 The point is academic in any case since the CN/CP Telecommunications operations clearly fall within the scope of s 92 (10)(a)

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31 As *fell* for determination, for example in *R.* v *O.L.R.B ex parte Dunn* (1963), 39 O L R (2d) 346, and v *O L R B ex parte Northern Electric*, [1970] 2 O R 654, with mixed results

When data communications links are added to the computer, the situation becomes considerably more complex. Among the questions that must be addressed are the following: How closely integrated are the data communications facilities with the data processing facilities? Who owns or provides each? What is the mode of electronic transmission? Are the remote links provided by a telecommunications carrier and, if so, is the carrier subject to federal or provincial regulation? Are the remote facilities co-used for other purposes, and is it possible to separate the computer/communications undertaking functionally or operationally? Do the links extend across provincial borders, or connect one province with another? How often or regularly are the interprovincial links used? Who effectively manages, markets, or controls the undertaking?

Most of these questions arise because of the language of S. 92(10)(a), which refers to works or undertakings *connecting* one province with others or *extending* beyond the physical limits of a single province. While works are normally considered physical installations, an undertaking has been defined judicially as "an arrangement under which...physical things are used".[32] The determination of when a data communications network involving computer terminals in more than one province constitutes an interprovincial undertaking requires a close look at the nature of the "arrangement" in each case.

An initial difficulty is the question of the physical connection. The language of s. 92(10)(a) suggests that a border connection between two entities offering an interprovincial service through the joint use of each other's facilities would give rise to federal jurisdiction. On the other hand, it has been held that a highway is not an interprovincial work or undertaking where it runs to a provincial border and there abuts on a highway of the adjacent province.[33] Again, the connection between a "local" railway and a railway declared to be for the general advantage of Canada has in one case been held not to subject the former to federal jurisdiction in the absence of common or integrated operation.[34] The relevance of these cases to communications is still a matter of dispute. TCTS members have contended that the holdings in these cases apply to the operations of the provincially incorporated telephone companies so as to bring them totally within provincial jurisdiction.[35] Other commentators, basing their argument on a variety of cases relating to

32 Per Lord Dunedin in the *Radio References*, [1932] A.C. 304 at 315

33 *S.M.T. (Eastern) Ltd.* v. *Ruch*, [1940] 1 D.L.R. 190

34 *Montreal* v. *Montreal Street Railway*, [1912] A.C. 334

35 For the basic conflict, see *Telecommission Study* 1(a)

railways, pipelines and electric power networks,[36] have contended that the interdependence and integration of the telephone systems in an operational sense subjects them to federal jurisdiction, at least with respect to interprovincial tolls, and possibly with respect to their entire operations.[37]

It is clear from such cases that integration of management or operational dependence or control is a critical factor in determining whether otherwise "local" systems constitute part of an interprovincial undertaking. The place of incorporation, federal or provincial, of the relevant company will not determine the regulatory jurisdiction under which its works or undertakings fall.[38] Nor will the fact that two distinctly separate activities are carried on by the same company suffice to integrate them for jurisdictional purposes.[39] The critical factor appears to be integration of operation in the practical or working sense and, where this exists, the courts have been willing to ignore the separate corporate identities of parent and subsidiary companies, and have treated them as a single entity for jurisdictional purposes.[40] Corporate objects or powers have not been determinative, except where they have constituted evidence of integration of management or operation.

The extent and nature of the extraprovincial activity has also been the subject of comment in the cases. The well-known *City of Toronto* v. *Bell Telephone* case held that the Bell undertaking could not be broken down into separate local and long-distance businesses, so as to subject the company to different legislative jurisdictions: the integration of services was sufficient to require them to be treated as one undertaking.[41] Since s. 92(10)(a) refers to the work or undertaking as such, and not to its interprovincial features, the courts have held that a work or undertaking falls completely within federal jurisdiction if it has some interprovincial extensions in practice. But what constitutes sufficient extra provincial activity to bring s. 92(10)(a) into play? This is particularly relevant to data communications networks, which may be used heavily and continually on a local basis, but with provision for occasional connections to subscribers in other provinces.

[36] *Hewson* v *Ontario Power Co* [1905] 36 SCR 596: *Ottawa Valley Power Co* v *HEPCO* [1936] 4 DLR 594: *Luscar Collieries Ltd* v *McDonald British Columbia Power Corp* v *A-GBC* [1963] 47 DLR 2d 633

[37] See Lederman *op cit*, *supra* note 28 *Telecommission Study 1(a)*, *City of Toronto* v *Bell Telephone Co* [1905] AC 52

[38] *CPR* v *A-GBC* [1950] AC 122 [1950] 1 DLR 721

[39] See cases cited in notes 31 and 38 above

[40] *R* v *OLRB ex parte Northern Electric* [1970] 2 OR 654 11 DLR (3d) 640

[41] *City of Toronto* v *Bell Telephone Co of Canada* [1905] AC 52

On this issue, the provincial courts have generally taken the position that, at least with regard to transportation undertakings, the percentage of the company's traffic which crosses a provincial boundary is not decisive, but the character of the traffic must satisfy certain standards of regularity in service offered.[42] Until recently, this question has not reached the Supreme Court of Canada, but in the *Agence Maritime* case, decided in 1969, the Court appears to have accepted the guide-lines developed in the lower courts.[43] Mr. Justice Fauteux did not examine in depth the question of what interprovincial service would be regarded as "reasonably regular" for the purpose at hand. He cited with approval, however, a lower court decision to the effect that extraprovincial business (here by a shipping line) need not be made in accordance with a printed time-table to satisfy the test, so long as the carrier offers constant and uninterrupted extraprovincial service to all those who ask for it.[44]

How do these principles apply to computer/communications networks? In a typical configuration, a service bureau may offer access on a time-sharing basis to its computer data bank and central processing unit to anyone from outside the province prepared to lease a dedicated direct line to its establishment. Alternatively, the service bureau may itself lease dedicated lines across the country, and propose that customers lease private lines to connection centres set up on the network by the service bureau. The cases suggest that if the extra-provincial activity is sufficiently regular and there is an interdependence and integration between the component parts of the network, the network will fall under federal jurisdiction. The ownership of the various component parts need not necessarily be in the same hands; what is important is the extent to which the parts have been organized under a common control to facilitate simultaneous interaction with the computer.

It should be noted at the same time that the above discussion does not necessarily preclude the possibility of distinguishing the question of jurisdiction over provincial telephone companies, where such companies merely provide physical facilities and no marketing or management, from the question of jurisdiction over the computer/communications network itself. The distinction is best seen in comparing the *Ruch* case with the *Winner* case; in the former,[45] it was held that highways abutting on provincial borders were not in themselves subject to federal jurisdiction; in the *Winner* case,[46] it was held

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42 See, for example, *R. v Toronto Magistrates*, [1960] O R 497, 25 D L R 2d 161; affirmed sub nom *Re Tank Truck Transport Ltd*. [1963] 1 O R 272, 36 D L R 2d 636; *R v Cooksville Magistrate's Court* [1965] 1 O R 84, 46 D L R 2d 700

43 *Agency Maritime Inc v C L R B* [1969] S C R 851, 12 D L R 3d 722

44 [1969] S C R 851 at 857-58 12 D L R 3d 722 at 726-7

45 *S M T (Eastern) Ltd v Ruch* [1940] 1 D L R 190

46 *A.-G. Ont v Winner*, [1954] 4 D L R 657, [1954] A C 541

that an operator using these same highways to serve customers in more than one province was carrying on an interprovincial undertaking within the meaning of s.92(10)(a). The recent Supreme Court of Canada decision relating to *GO Transit* held, on the other hand, that the fact that a local service co-uses the physical lines of an interprovincial carrier *ipso facto* renders it subject to federal control.[47] These results suggest that it is not impossible to separate the jurisdiction over the physical plant from the jurisdiction over the undertaking using such plant, but that a provincial carrier that becomes directly involved in designing, managing or marketing an undertaking using integrated computer/communications facilities in more than one province may find itself under federal jurisdiction in respect of such activity.
Left relatively untouched in the foregoing discussion has been the problem of the degree of integration required for a computer/communications network to constitute a definable "undertaking". The example posed above was relatively free from doubt; dedicated private lines and terminals designed specifically for computer interaction were involved, and the use of such lines was regular and continuing. A much more difficult problem is posed when remote-access is available only through the regular telephone system and the use of the computer even on this basis is sporadic and occasional. The dividing line between these two configurations is likely to be a difficult one to draw and must await further judicial determination.

A further comment may be addressed to the question of concurrent powers. Although the B.N.A. Act speaks of "exclusive" jurisdiction over local or interprovincial undertakings, this is subject to the exercise of a variety of other legislative powers that have direct or indirect relevance to computer/communications systems. With regard to interprovincial undertakings, exclusive federal jurisdiction relates to "all matters which are a vital part of the operation of an interprovincial undertaking as a going concern."[48] But provincial legislation touching on such matters as taxation, workmen's compensation, tort liability, and the collection of data, would likely be upheld in the absence of conflicting federal legislation.[49] In addition, the use of national computer/communications systems by provincial institutions (*e.g.*, hospitals, schools, municipalities, motor vehicle registration, the administration of justice) would be subject to provincial direction.

At the same time, computer/communications networks or computer data banks that are "local", and hence under provincial jurisdiction are also subject to some concurrent federal controls. The use of radio frequency

[47] *The Queen* v *Board of Transport Commissioners* [1968] 65 D L R 2d 425

[48] Per Martland J in *Commission du Salaire Minimum* v *Bell Telephone Co of Canada*. [1966] S C R 767 at 772 59 D L R 2d 145 at 148

[49] The various cases are collected in Grant *op cit. supra*, note 28

spectrum by such networks would be licensed federally, for example;[50] in addition, such networks or data banks would be subject to the federal Criminal Code, the Combines Investigation Act, the Patent Act, the Copyright Act, and other federal statutes relating to such matters as taxation, customs tariffs, and the census. The use of local networks or data banks by federally regulated institutions (*e.g.* chartered banks, airlines, federal government departments) would also be presumably subject to federal direction.

As noted in *Instant World*, telecommunications services are "profuse, various, complex, interdependent, and of vital concern to all the people of Canada."[51] When telecommunications services are allied with those of the computer, both the provinces and the federal government have legitimate concerns which require mutual co-operation in order that the goals of each can be achieved. The constitutional framework in Canada is in the process of considerable adjustment in response to these needs and the need for co-ordination of the various concerns and approaches has never been more pressing.

[50] *Re Regulation and Control of Radio Communication*, [1932] AC 304, [1932] 2 DLR 81

[51] *Instant World*, p 211

APPENDIX TO PART A

APPENDIX 1

TABULAR SUMMARY OF REGULATORY JURISDICTION OVER MAJOR CANADIAN TELECOMMUNICATIONS CARRIERS

NAME OF CARRIER	SIZE, OPERATING TERRITORY, OWNERSHIP (1970 figures)	INCORPORATING LEGISLATION	REGULATORY AGENCY RESPONSIBLE FOR GENERAL RATE REVIEW, APPLICABLE STATUTES
A. TELEPHONE COMPANIES (in order of no. of telephones)			
Bell Canada	Canada's largest carrier; operates in Ontario, Quebec with 6,007,507 telephones; $936.6 million in operating revenues. Publicly held; 95% Canadian owned. AT&T interest is 2.1% of outstanding shares.	S.C. 1880, c.67, as amended (12 amendments have been made so far). S.C. 1882, c.95, s.4, declares the works authorized to be for the general advantage of Canada. S.C. 1967-68, c.48, s.6 permits foreign attachments subject to CTC review; forbids Bell from controlling contents of messages.	Canadian Transport Commission (Telecommunication Committee). See *Railway Act*, R.S.C. 1970, c.R-2; *National Transportation Act*, R.S.C. 1970,c.N-17.
British Columbia Telephone Company	Operates in British Columbia with 982,503 telephones; $168.9 million in operating revenues. Controlled 51.3% by General Telephone & Electronics Corp., a New York company through a Quebec subsidiary, Anglo-Canadian Telephone Company.	S.C. 1916, c.66, as amended in 1940-41, c.36, 1947, c.86, 1957, c.40, and 1960, c.66. Section 2 declares the works authorized to be for the general advantage of Canada. S.C. 1960, c.66, s.1 precludes company from acquiring shares of carrier companies without CTC approval.	Canadian Transport Commission (Telecommunications Committee). See *Railway Act*, R.S.C. 1970, c.R-2; *National Transportation Act*, R.S.C. 1970, c.N-17.

NATURE OF PRESENT REGULATORY JURISDICTION
OVER DATA COMMUNICATIONS,
FOREIGN ATTACHMENTS, INTERCONNECTION

Under ss.320 & 321 of the Railway Act, CTC may review and revise all ''telegraph and telephone tolls'' charged by the company, as defined in s.2. Such tolls must be just, reasonable and non-discriminatory. Up to 1970, this did not apply to charges for leasing or using telephone wires ''where no toll is charged to the public'', but this private line exemption was removed on August 1, 1970. CTC thus has power to review all of Bell's data communication services where these use its telephone plant or facilities. CTC can permit separate classifications and rates for message services and review boundaries of base rate areas. CTC has so far limited its review to overall rate of return only, and not return on individual services, but it has begun to hear complaints relating to specific tariffs and restrictions, particularly PBX and CATV pole use. The Bell Act permits foreign attachments subject to reasonable requirements to be set up by the company and arbitrated by CTC, requires Bell to act ''solely as a common carrier'', without the power to ''control the contents'' or ''influence the meaning or purpose'' of messages, and obligates Bell to furnish telephones upon request to any person in its service area. CTC can also review agreements between Bell and connecting carriers, and (under the Bell Act) any capital issues by Bell. On January 12, 1972, the CTC announced its decision to undertake a study on cost accounting procedures of the telecommunications carriers, which is expected to include an analysis of cost separations and cross subsidization, if any, between individual voice and data services.

Under ss.320&321 of the Railway Act, CTC may review and revise all ''telegraph and telephone tolls'' charged by the company, as defined in s.2. Such tolls must be just, reasonable and non-discriminatory. Up to 1970, this did not apply to charges for leasing or using telephone wires ''where no toll is charged to the public'', but this private line exemption was removed on August 1, 1970. CTC thus has power to review all B.C. Tel's data communication services where these use its telephone plant or facilities. CTC can permit separate classifications and rates for message services and review boundaries of base rate areas. CTC has so far limited its review to overall rate of return only, and not return on individual services but it has begun to hear complaints relating to specific tariffs and restrictions, e.g. hotel PBX. CTC can also review agreements between B.C. Tel and connecting carriers and (under the B.C. Tel Act) any acquisition of shares or assets of companies with similar objects, and any capital issues by B.C. Tel. CTC has no specific powers to compel interconnection with non-carriers or to rule on foreign attachments save through the revision of suggested tariffs where such tariffs are discriminatory. On January 12, 1972, the CTC announced its decision to undertake a study on cost accounting procedures on the telecommunications carriers, which is expected to include an analysis of cost separations and cross subsidization, if any, between individual voice and data services.

Alberta Government Telephones	Operates in Alberta with 510,266 telephones; $109.9 million in operating revenues. A Crown Corporation of the province of Alberta.	*Alberta Government Telephones Act*, R.S.A. 1970 c.12, as amended in 1971, c.2	Alberta Public Utilities Board. See *Public Utilities Board Act*, R.S.A. 1970, c.302, as amended.
Manitoba Telephone System	Operates in Manitoba with 435,606 telephones; $58.6 million in operating revenues. A Crown Corporation of the province of Manitoba.	*The Manitoba Telephone Act*, R.S.M. 1970, c.T-40, as amended in 1971, c.82, s.55.	Manitoba Public Utilities Board. See *Public Utilities Board Act*, R.S.M. 1970, c.P-280.
Saskatchewan Telecommunications	Operates in Saskatchewan with 314,981 telephones; $50.5 million in operating revenues. A Crown Corporation of the province of Saskatchewan.	*The Saskatchewan Telecommunications Act*, R.S.S. 1965, c.42, as amended in 1966, c.7, 1968, c.62, 1969, c.52, 1971, c.46.	Self-regulated through cabinet-appointed board of directors, the Minister of Telephones, and a select standing committee of the Saskatchewan Legislature.
Maritime Telephone & Telegraph Company Limited	Operates in Nova Scotia with 281,363 telephones; $44.0 million in operating revenues. Owned 52.4% by Bell Canada since 1966, subject to limitation of votes to 1,000 shares.	Stat. N.S. 1910, c.156 as amended (15 amendments have been made so far). Stat. N.S. 1966, c.5,s.1, precludes any one person from voting more than 1,000 shares at any meeting of the company.	Nova Scotia Board of Commissioniers of Public Utilities. See *Public Utilities Act*, R.S.N.S. 1967, c.258, as amended in 1970, c.65.

Under the Public Utilities Board Act, the Board is given the authority to revise AGT's tolls or charges if they exceed what is just and reasonable, or if they are unjustly discriminatory. Since the definition of a public utility includes "any system...for the conveyance of telegraph or telephone messages", it is arguable that both public and private line services, whether voice or data, come under Board jurisdiction. The question has not yet been raised however, since the Board presently regulates AGT on the basis of its overall rate of return. Separate service offerings have not been the subject of direct regulation to date, although AGT is required to file its schedule of rates with the Board for approval. The Board has a general supervisory power, and can direct AGT with respect to its accounting practices, extension of its works or systems, maintenance of "safe, adequate and proper service", and classification of individual rates. AGT must also seek Board approval for debenture issues. Joint use of poles, wires or equipment by public utilities can also be ordered by the Board, and the Board can order interconnection between telephone systems and arbitrate the conditions therefor. No interconnection with non-carriers can be ordered however and the AGT Act prohibits attachments not owned by the corporation except with AGT permission.

Under s.77 of the Public Utilities Board Act, the Board may review and revise all rates and tolls charged by MTS as a public utility, i.e. as a system for the transmission of telephone messages directly or indirectly, to or for the public. Tolls or individual special rates can be revised by the Board if they are unjust, unreasonable, insufficient, or unjustly discriminatory or 'preferential'. Some technical regulation as to methods, standards and safety is also allowed, but the Board has no direct jurisdiction to review capital issues or construction expenditures save to the extent that rate regulation affects such matters. Arguably, the Board might be able to exercise jurisdiction over the rates for private line services, including dedicated data offerings, but such rates are not at present reviewed by the Board and the Board's jurisdiction is unclear. Interconnection may be ordered between MTS and other public utilities but not to non-carriers. MTS may prohibit foreign attachments if in its opinion such would injuriously affect its equipment. No review power over such matters is given to the Board, save in regard to discrimination.

No independent agency reviews Sask Tel tariffs, but as a matter of policy, any significant adjustments are referred to the directors and responsible minister and often to Cabinet for approval. Similarly, significant capital issues or construction projects are submitted for the approval of the directors and the Minister. The Sask Tel Act requires all rates for its services to be published, save where special agreements for particular services are negotiated. Save through an appeal to cabinet, Sask Tel cannot be required to interconnect with other carriers or non-carriers or to permit the use of foreign attachments. However, other telephone systems in Saskatchewan can be required by the Minister of Telephones to interconnect with Sask Tel.

The Nova Scotia Board is given the power to review and approve any rate of charge made by MT&T for any services performed or facilities provided by it as a public utility under the Act. Tolls must be submitted to and approved by the Board and must not be unreasonable or unjustly discriminatory. The Board is also given authority to control and regulate technical and safety matters, the issuance of securities, accounting procedures, and expenditures on capital construction over $5,000. Although it is not clear that its jurisdiction is so limited, the Board has restricted its review to voice services, either private line or public switched, and has not seen fit to regulate other uses of MT&T facilities, e.g. for data communications services. Rates for non-regulated services, including TWX, are therefore not submitted for approval. Interconnection of MT&T facilities with those of rural telephone companies may be ordered by the Board, but otherwise the MT&T Act appears to give an unlimited right to the Company to refuse to permit foreign attachments or interconnection.

New Brunswick Telephone Company Limited	Operates in New Brunswick with 225,121 telephones; $40.8 million in operating revenues. Owned 51% by Bell Canada.	Stat. N.B. 1888, c.78, as amended in 1907, c.58 and 1949, c.67.	New Brunswick Board of Commissioners of Public Utilities. See *Public Utilities Act*, R.S.N.B. 1952, c.186, as amended; *Telephone Companies Act*, R.S.N.B. 1952, c.226, as amended.
··dmonton telephones	Operates in City of Edmonton with 218,022 telephones; $20.3 million in operating revenues. A municipal telephone system owned by the City of Edmonton.	Operated under authority granted the City under the *Municipal Telephone Act*, R.S.A. 1955, c.218.	Rates fixed by the elected representatives of the City of Edmonton.
Québec-Téléphone	Operates in eastern Quebec with 133,867 telephones; $26.1 million in operating revenues. Controlled by General Telephone & Electronics Corp., a New York company, through a Quebec subsidiary, Anglo Canadian Telephone Company.	Constituted under the *Telegraph and Telephone Companies Act*, R.S.Q. 1964, c.286.	Quebec Public Service Board. See *Public Service Board Act*, R.S.Q. 1964, c.229.
Newfoundland Telephone Company Limited	Operates in Newfoundland with 92,991 telephones; $17.5 million in operating revenues. Owned 99.6% by Bell Canada since 1962.	Stat. Nfld. 1925, n.10 as amended (7 amendments have been made so far). Name changed from the Avalon Telephone Company Ltd. in 1970.	Newfoundland Board of Commissioners of Public Utilities. See *Public Utilities Act*, Stat. Nfld. 1964, no.39, as amended in 1966, no.26 and 1969, no.7.

The New Brunswick Board is given the authority to review and revise all rates or tolls charged by N.B. Tel as a public utility, i.e. as a person owning plant or equipment for the conveyance of telephone messages to or for the public. Such tolls and any practices of N.B. Tel can be modified by the Board if they are unreasonable, insufficient or unjustly discriminatory; in addition the Board can order extension of service to an area. Although the Board arguably possesses such jurisdiction, it has ruled on a variety of occasions beginning in 1962 that any services provided by N.B. Tel that are not connected for intercommunication with the company's general local or long distance telephone network are not subject to its regulation. Hence the Board does not review private line services of N.B. Tel, whether voice or data. The Board has reviewed the company's rate of return only *in toto* and has not required N.B. Tel to separate out the costs for its non-regulated services; in 1969, however, it requested the company to study this question further. Under the Telephone Companies Act, N.B. Tel can be required to interconnect with other telephone companies by the provincial cabinet but this does not apply to non-carriers. No power is given to the Board to compel N.B. Tel to interconnect or to rule on foreign attachments save through the revision of suggested tariffs for public services where such tariffs are discriminatory.

Under the Public Utilities Board Act, telephone systems owned by municipalities only fall within Board jurisdiction where such municipalities have passed a by-law to this effect. The City of Edmonton has not so far submitted its system to Board jurisdiction and hence edmonton telephones is largely self-regulated. The Board does however arbitrate interconnection disputes between AGT and edmonton tel. Rates for edmonton tel services are subject only to council approval, and save through an appeal to council, edmonton tel appears to have an unlimited right to refuse to permit foreign attachments or interconnection with non-carriers.

Québec Tel comes under the jurisdiction of the Board, as operating "any service for the transmission by wire or wireless of telegraphic or telephonic messages, or by the two means combined". Rates and contracts of Québec Tel must be fair and reasonable, and must be filed and approved by the Board. The Board can also require the company to adopt measures relating to such matters as quality of service, equipment, apparatus, extension of works or systems, message routes, reports to be made, and conditions and practices respecting rates or prices. Private lines services, whether voice or data, are therefore directly under Board jurisdiction, and although the Board has to date been concerned chiefly with overall rate of return, it proposes to evaluate individual service offerings, including remote access data processing, more closely. The Board's approval is required for cessation of operations, extension of service, and any merger or sale affecting public service. The Board can compel interconnection between Québec Tel and other public services, but no other power with regard to interconnection or foreign attachments is given to the Board.

No public utility (which includes Newfoundland Tel) may charge compensation for any service performed by it whether for the public or under contract without the approval of its rates or tolls by the Board. The Board may investigate and make orders to remedy unreasonable or discriminatory rates or practices or inadequate service. Board approval is also required for construction expenditures in excess of $25,000, and for abandonment of service, changes in equipment type, and transfer of any of the undertaking. Hence all data communication services are reviewed by the Board although "non-telecommunications services" (e.g. directory advertising) are unregulated. The Newfoundland Telephone Act prohibits attachments not owned by the company except with company permission. Joint use of poles or wires by public utilities may however be arbitrated by the Board.

Thunder Bay Telephone	Operates in the City of Thunder Bay with 56,134 telephones; $3.4 million in operating revenues. A municipal public utility owned by the City of Thunder Bay.	A public utility operated under authority granted the City under the *Telephone Act*, R.S.O. 1970, c.457, s.27 and the *Public Utilities Act*, R.S.O. 1970, c.390, Parts III and IV.	Ontario Telephone Service Commission. See *Telephone Act*, R.S.O. 1970, c.457; *Public Utilities Act*, R.S.O. 1970, c.390, Parts III and IV.
Okanagan Telephone Company	Operates in south central British Columbia with 55,181 telephones; $6.0 million in operating revenues. Owned 100% by B.C. Telephone Company since 1966.	Stat. B.C. 1907, c.35 as amended by 1913, c.90, 1937, c.80, 1951, c.100.	British Columbia Public Utilities Commission. See *Public Utilities Act*, R.S.B.C. 1960, c.323, as amended.
Téléphone du Nord de Québec Inc.	Operates in northwestern Quebec with 49,959 telephones; $7.4 million in operating revenues. A subsidiary of Northern Telephone Limited, which is controlled by Bell Canada.	Constituted under the *Telegraph and Telephone Companies Act*, R.S.Q. 1964, c.286.	Quebec Public Service Board. See *Public Service Board Act*, R.S.Q. 1964, c.229.
Northern Telephone Limited	Operates in northern Ontario with 48,241 telephones; $4.6 million in operating revenues. Owned 88% by Bell Canada since 1966.	Holds private charter issued under the *Telephone Act*, R.S.O. 1970, c.457, s.87.	Ontario Telephone Service Commission. See *Telephone Act*, R.S.O. 1970, c.457.

Thunder Bay Tel, as a public utility carried on under s.27 of the Telephone Act, is subject to the authority of the Commission, which can require rates and tolls to be revised if they are discriminatory, excessive, or insufficient. The definition of "rates" limits the jurisdiction of the Commission to rentals or charges "for supplying telephone exchange service and all services associated therewith". Dedicated data offerings may therefore fall outside Commission jurisdiction in some circumstances; such offerings are presently filed with the Commission although no active regulation of private line services has been undertaken to date. The consent of the Commission is required for acquisition or sale of telephone undertakings, for the provision of non-interconnection or joint use agreements with other utilities. The Commission may compel telephone service to be furnished upon request, make orders with respect to adequacy of service, require interconnection with other telephone systems, and can regulate accounting practices, and the type of construction and maintenance. Foreign attachments which injure or damage the system are prohibited and the Act requires the utility to "own and maintain all equipment...operated in connection with the system", unless otherwise consented to by the Commission. Interconnection with non-carriers cannot be ordered.

Under the Public Utilities Act, the PUC regulates Okanagan Tel as a person owning equipment or facilities for the conveyance of messages or communications by telephone or telegraph, where such service is offered to the public or any corporation for compensation. All rates, tolls and practices of Okanagan Tel must be just, reasonable, and not unjustly discriminatory. Although rates for private line services, whether voice or data, are filed with the Commission and subject to its approval, the PUC has made no attempt to segregate their cost and revenues when regulating Okanagan's overall rate of return. The Commission is given the power to determine standards of service, to require joint use of poles, wires or equipment by public utilities, to require interconnection between telephone systems (for the conveyance of messages only), and to order extension of service. No other power with regard to interconnection or foreign attachments is given to the Commission.

Téléphone du Nord de Québec comes under the jurisdiction of the Board, as operating "any service for the transmission by wire or wireless of telegraphic or telephonic messages, or by the two means combined". Rates and contracts of the company must be fair and reasonable, and must be filed and approved by the Board. The Board can also require the company to adopt measures relating to such matters as quality of service, equipment, apparatus, extension of works or systems, message routes, reports to be made, and conditions and practices respecting rates or prices. Private line services, whether voice or data, are therefore directly under board jurisdiction, and although the Board has to date been concerned chiefly with overall rate of return, it proposes to evaluate individual service offerings, including remote access data processing, more closely. The Board's approval is required for cessation of operations, extension of service, and any merger or sale affecting public service. The Board can compel interconnection between the company and other public services, but no other power with regard to interconnection or foreign attachments is given to the Board.

Under the Telephone Act, Northern Tel is subject to the authority of the Commission, which can require rates and tolls to be revised if they are discriminatory, excessive or insufficient. The definition of "rates" limits the jurisdiction of the Commission to rentals or charges "for supplying telephone exchange service and all services associated therewith". Dedicated data offerings may therefore fall outside Commission jurisdiction in some circumstances; such offerings are presently filed with the Commission although no active regulation of private line service has been undertaken. The consent of the Commission is required for acquisition or sale of telephone undertakings, for debenture or capital stock issues, for changes in company by-laws, and for interconnection or joint use agreements with other utilities. The Commission may compel telephone service to be furnished upon request, make orders with respect to adequacy of service, require interconnection with other telephone systems, and can regulate accounting practices, and the type of construction and maintenance. Foreign attachments which injure or damage the system are prohibited and the Act requires the company to "own and maintain all equipment...operated in connection with the system", unless otherwise consented to by the Commission. Interconnection with non-carriers cannot be ordered.

Island Telephone Company Limited	Operates in Prince Edward Island with 34,132 telephones; $3.9 million in operating revenues. Owned 56% by Maritime Telegraph & Telephone Co. Ltd.	Stat. P.E.I. 1929, c.30 as amended (7 amendments have been made so far).	Prince Edward Island Public Utilities Commission. See *Public Utilities Commission Act*, R.S.P.E.I. 1951, c.133 as amended; *Electric Power and Telephone Act*, R.S.P.E.I. 1951, c.49.

B. OTHER TELECOMMUNICATIONS CARRIERS

Canadian National/ Canadian Pacific Telecom-munications	Provides a nationwide telecommunications service, including public message-telegraph, Telex, and Broadband Exchange Service. CNT also offers public telephone service to 35,000 subscribers in parts of Newfoundland, Yukon and N.W.T. $435.2 million in plant; $100.8 million in operating revenues. A consortium of the telecommunications departments of CNR (a federal Crown corporation) and CPR (a Canadian publicly-owned transportation company).	Not separately incorporated. A consortium of the tele-communications departments of the C.P.R. (see S.C. 1880, c.1, as amended) and the C.N.R. (see S.C. 1919, c.13, as amended - now R.S.C. 1970, c.C-10).	Canadian Transport Commission (Telecommunication Committee). See *Telegraphs Act*, R.S.C. 1970, c.T-3; *Railway Act*, R.S.C. 1970, c.R-2; *National Transportation Act*, R.S.C. 1970, c.N-17.
Canadian Overseas Telecom-munications Corporation	Provides overseas telecom-munications links to most parts of the world, other than U.S., through interconnections with the global networks of submarine cables, HF radio circuits, and the INTELSAT satellites. $123.0 million in plant, $32.7 million in operating revenues. A federal Crown corporation.	*Canadian Overseas Telecommunications Corporation Act*, R.S.C. 1970, c.C-11. Section 3(9) requires the corporation to comply with any directions given to it by the cabinet or the Minister of Communications.	Canadian Transport Commission (Telecommunication Committee). See *Telegraphs Act*, R.S.C. 1970, c.T-3, Part III; Railway Act, R.S.C. 1970 c.R-2; *National Transportation Act*, R.S.C. 1970, c.N-17.

The PUC is given power to regulate public utilities by the Electric Power and Telephone Act, which allows the PUC to review and remedy rates, tolls and practices which are unreasonable, insufficient, or unjustly discriminatory, and to prescribe conditions to ensure that Island Tel furnishes reasonably adequate service and facilities if such service is inadequate or unobtainable. Island Tel falls within the definition of a public utility, as a person owning plant or equipment for the conveyance of telephone messages to or for the public. Although the PUC appears to have sufficient jurisdiction to regulate data services, whether or not private line, it has to date regulated Island Tel only with regard to its overall rate of return. The PUC has stated however that it expects no class of service to be subsidized by any other, and it is specifically given the power (so far not exercised) to fix and determine a separate earnings base for each type of service furnished or supplied to the public. PUC approval is required for the installation of equipment which is not of a uniform design and the product of a standard manufacturer, for the construction or alterations of any plant at a cost exceeding $1,000, and for the sale of any part of the undertaking. The PUC can require Island Tel to interconnect or share use of its facilities with other public utilities furnishing telephone or hydro service, but no other power with regard to interconnection of foreign attachments is given to the Commission.

Under ss.320 & 321 of the Railway Act, CTC may review and revise all "telegraph and telephone tolls" charged by the two companies, whether separately or as a consortium. (Both CPR and CNR are also subject to CTC review in respect of their rail, shipping, and air operations.) Such tolls must be just, reasonable and non-discriminatory. Up to 1970, this did not apply to charges for leasing or using telecommunications links "where no toll is charged to the public", but this private line exemption was removed on August 1, 1970. CTC thus has power to review all of CN/CPT data communication services, including services such as Telex and Data Telex exempted prior to 1970. Although tariffs for these services are filed with CTC, however, the Commission has not actively regulated in this area to date, since rates are presently being set on a competitive basis. CTC has no specific powers to compel CN/CPT to interconnect with other carriers or to rule on foreign attachments save through the revision of suggested tariffs where such tariffs are discriminatory. On January 12, 1972, the CTC announced its decision to undertake a study on cost accounting procedures of the telecommunications carriers, which is expected to include an analysis of cost separations and cross subsidization, if any, between individual voice and data services.

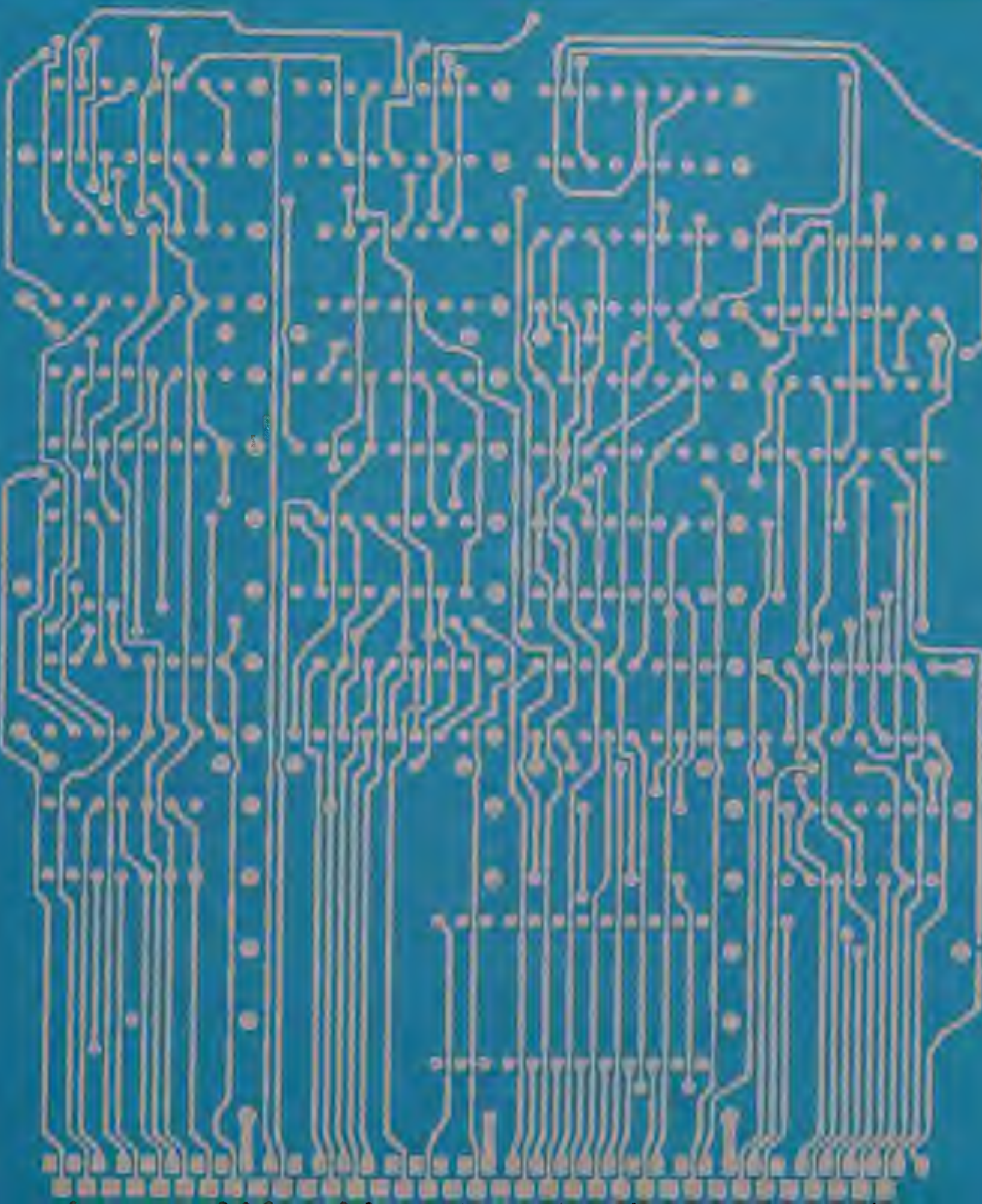
COTC is brought under the jurisdiction of CTC in respect of its tariffs for messages by virtue of both the Telegraphs Act and the Railway Act. Under the latter Act, such tariffs must be just, reasonable and non-discriminatory, although CTC can permit separate classifications and rates for message services. COTC has not in fact filed its tariffs with the Commission, nor has the Commission requested it to do so, although CTC appears to have the power to require COTC tariffs to be filed and approved, both in respect of public services and private line offerings. In most cases, data communications customers do not deal directly with COTC but instead are billed directly by the domestic carriers providing the links to the COTC gateways. CTC has no specific powers to compel interconnection between COTC and carriers or non-carriers or to rule on foreign attachments save through the revision of suggested tariffs where such tariffs are discriminatory. COTC is however subject to directions from the Minister on such matters.

Telesat Canada	Canadian corporation created in 1969 to establish and maintain a commercial system of domestic satellite communications in Canada. ANIK I satellite expected to begin operations in 1973. $60 million share capital split equally at present between Government of Canada and 13 approved telecommunications carriers. Remaining $30 million expected to be raised from public through debt or equity issue. Able to lease up to 10 channels at about $3 million each.	*Telesat Canada Act*, R.S.C. 1970, c.T-4. The company is declared in s.34 to be neither an agent of Her Majesty nor a Crown corporation.	No general regulatory review at present. Certain powers are given to the Minister of Communications under the *Telesat Canada Act* to approve construction contracts, financing share transfers, and negotiations with foreign states. Telesat is also subject to licensing procedures under the *Radio Act*, R.S.C. 1970, c.R-1, for its use of rf spectrum.

No statutory restrictions apply to Telesat Canada at present with respect to its tariffs, and it is presumably free, subject to direction from its 11-man board of directors, to set whatever rates or conditions its customers are prepared to accept. The present system configuration of Telesat is such that most customers will need to deal separately with the carriers in order to obtain microwave backhauling and local loops. In addition, Telesat has so far required that any customer lease a minimum of one rf channel. It may be noted in passing that, depending on the interpretation of the term ''telephone system'' in s.320(1) of the Railway Act, it is possible that Telesat's rates fall under the jurisdiction of the CTC. The point is an academic one at present, however, since the Telesat customers (the carriers and the CBC) have significant negotiating power of their own because of the competitive alternatives. In any case, Bell, B.C. Tel, and CN/CPT contracts with Telesat would presumably be reviewable under s.320(11.

Part 8

Applications of Computer/ Communications in Canada in Three Fields of Social Significance



Automation of Payments
and Credits

INTRODUCTION

This study contains the results of an investigation into the use of computers and communications for the provision of financial and financially-related services. More specifically, the study attempts to achieve the following objectives:

- To project and explain changes in the Canadian payments and credit system, based on the use of computer/communications;
- to estimate the demand for equipment, skills and telecommunication facilities necessary to develop, implement and operate the new systems;
- to identify problems which in the present or the future, are likely to inhibit the development of an electronic payments/credit system;
- to assess the probable economic and social effects of an electronic payments/credit system.

Chapter I
Current Status of Bank Automation

1. BACKGROUND

The current phase of bank automation in Canada began in 1963 with the introduction of magnetic ink character recognition (MICR) reader-sorters and business computers. Because of the predominant use of the cheque in our payments system, much of the initial effort was directed toward mechanization of cheque-handling. Paper handling has always been a huge and growing problem in the banking industry, as evidenced by the increase in the number of cheques cashed through the clearing system. The volume has risen from 300 million cheques in 1950 to 1.3 billion in 1970. If the number of people employed by the banks had risen in proportion to the increase in the number of cheques, the Canadian banking industry would now employ about 190,000 people instead of 93,000. It is estimated by the Canadian Bankers' Association that approximately two-thirds of the Canadian chartered banks' operating expenses, other than interest on deposits and income-taxes paid, can be allocated to the payments function.

One of the prime arguments for automation is cost reduction through greater productivity. A further spur to automation is the critical need to conserve space; as many existing branches in the cities have no room to expand and to increase business volume, they must more effectively utilize the space which is now available. Diversification of customer services tailored to customers' requirements, better employee working conditions, and improved management control, are further reasons for the increasing need for automation.

Most of a bank's "production" is the processing and storage of information, which makes them prime candidates for electronic data processing (EDP). Since automation can provide a competitive advantage, there are many independent efforts underway to design and implement on-line banking systems. Systems-design approaches and development schedules vary dramatically from bank to bank. There is some aversion toward co-operative efforts, shared design or facilities such as might be co-ordinated through the Canadian Bankers' Association (CBA). At present, the pressure of increasing costs is clearly forcing banks to concentrate on their internal mechanization, which means a further limitation of those resources which could be applied to automated customer services.

Notwithstanding their rivalry, the banks find it essential to co-operate on certain rules and arrangements in order to provide a flexible, workable payments system. Because of their mutual dependence, they have some reciprocal arrangements, such as lending equipment or services in case of emergency and MICR encoding each others' cheques. Through the CBA, the banks have standardized much of their interchange of information. More co-operative efforts are almost certain to evolve in situations where there is recognizable mutual advantage. However, such changes must occur at their natural pace to gain acceptance and to undergo the development necessary for the emergence of a smoothly running system. The managerial, technical, economic, and human problems are too complex to be amenable to solution by means other than an evolutionary process.

2. INTERNAL APPLICATIONS

For a Canadian commercial bank, most of the costs, revenues and profits stem from branch activity, so it is in the branch-network that the greatest potential exists for automation. Branch-bank accounting and clerical activity can be roughly categorized into a number of functions. These are listed in approximate order of work volume, although some have greater or lesser significance, depending on branch business:

- Demand Deposit Accounting (DDA)
- Term Deposit Accounting (Savings)
- Liabilities (Loans)
- General Ledger (including checking of day's entries)
- Preparation of Branch Returns
- Foreign Exchange
- Teller Cash Control
- Money Orders, Drafts, Letters of Credit and Travellers Cheques
- Securities (safe-keeping and collateral)
- Safety-Deposit Boxes

To eliminate the clerical/accounting chores in a branch, it is necessary to automate information handling tasks in all of these areas, plus a number of miscellaneous functions. Naturally, the banks have first concentrated on mechanizing the most labour-intensive functions in order to capitalize on the greatest opportunities for cost savings.

(a) Demand Deposits

The Demand Deposit Accounting (DDA) application is the highest-volume data processing activity of the banks. Basically, this application involves the proofing and clearing of cheques and the posting of debits and credits to customer accounts maintained on a computer file. There are many auxiliary functions, such as printing statements and calculating service-charges.

The use of computers in this function has enabled banks to keep down the costs of providing the payment services they offer, in spite of increasing volume of transactions and rising labour costs. The current direct cost of processing a straightforward MICR-encoded cheque is about 13 1/2 cents versus about 45 cents for a cheque that must be handled manually on an exception basis. Still the labour cost of cheque-processing represents a substantial amount of the total cost and there is little scope for further automation of cheque-handling, except by reducing the proportion of uncoded items (for example, government cheques). At present, DDA is a batch-processing activity which is performed at night. The service is usually provided to branches by a bank-operated data centre in the large cities. Input cheques and other vouchers are picked up from the branches by courier after branch closing time and returned, together with various reports, the next morning. It is estimated that approximately 60% of Canadian bank branches are using computerized DDA service, and an increasing number of branches are being converted to this method. Since most of the branches served are in high population areas, perhaps 80 — 90% of all current accounts and PCA accounts are now maintained on a computer.

(b) Savings

Savings-accounts have a much lower turnover with most transactions being initiated over the counter in the branch with the teller updating the customer's passbook. This pattern of savings-account activity is not easily adapted to batch-processing on computers. It demands an on-line real-time approach. Several Canadian banks have on-line savings terminals in use either on an experimental or a production basis. In total, there are 460 bank branches with on-line savings systems — 305 are in Toronto and the other 155 are in Montreal and Quebec City. The service provides for account updating via keyboard entry, passbook updating, account status inquiry and summary reporting. The market for on-line savings systems is dominated by the IBM Service Bureau, especially in Toronto. NCR, Burroughs and GE-Honeywell also operate such systems.

At present, most on-line savings terminals are linked to computers on manufacturers' premises. Communications between terminal control units and the CPU are carried out on leased voice circuits. Several control units are connected into one line by means of bridges, thus lowering the total cost to the user.

Ultimately the on-line savings system will lose its identity as such, and merge into a complete on-line banking system. Because this application must be integrated with all the other activities of the banks, its future as a manufacturer-supplied service is limited in the long-term. Already, some banks are taking the service on an in-house basis.

On-line savings is the first banking computer application in Canada using remote terminals. In some cases, the branches using the system are reducing costs, but more important is the fact that the banks are gaining experience with on-line systems, evaluating their effect on employees and customers and laying the groundwork for an expanded set of applications. In general, the result has been that tellers enjoy using the system as well as appreciate the further benefit of being able to leave work earlier. When a bank is able to offer guaranteed working hours, the immediate result is improved staff morale and lower turnover. A further side benefit is derived from the exposure of the customer to the use of the computer in handling his money.

(c) Loans

Next in order of priority is the whole area of loans including mortgages, commercial and consumer credit. All banks are in various stages of converting to automated liability accounting. The bulk of loan processing is in the initial set-up, including the calculation of interest and the automatic deduction of payments from deposit accounts. Most of this processing can be done off-line, so that the liabilities application lends itself naturally at present to the batch-processing approach. Most banks will nevertheless eventually extend the loans system to their branches for remote inquiry and data input and reporting. Ultimately this will mean faster and more personalized service for the customer.

Credit evaluation or rating is closely related to loans. In the process of assessing the credit-worthiness of a customer, the banks at present use the services of a credit bureau, or refer to their manually-kept records for established customers. Since loan interest is the chief source of bank revenue, the loan-granting process is critically important and can be expected to undergo more automation in the future. (This is discussed in Chapter III, Section 2).

Another area of significant and rapid growth in consumer credit activity is the bank charge-card plans. Currently, in those banks participating in Chargex, the administration of the card operation is organizationally and functionally separated from other bank activities. For this reason, it is not discussed here. However, it is probably only a matter of time before credit extended through the use of the card will be integrated with the other financial activities of each customer.

Computers are now firmly ensconced in banking, and will become even more essential if costs are to be controlled in the face of the growing volume of transactions, the demand by customers for more and better services and the increasing cost of labour. In relation to the potential for automation, however, the banks have really only scratched the surface. Nevertheless, there appear to be no serious constraints on the continuing development and implementation of new computer applications. In time, all of the above areas, and more, will be mechanized.

3. IMPACT ON BANK PRODUCTIVITY

Since 1966, general interest rate levels have risen. This is reflected in the average return on assets, as well as by the fact that banks have had a larger participation in the consumer loan and residential mortgage business. Profit margins are primarily determined by the spread in the costs of and the return on funds. For the banks, the costs of borrowing have risen even faster than the rate of return, which more than offsets the potential increase in profits from this source. It can therefore be seen that the improvement in profit margins experienced by banks is due, in part, to increased operating efficiencies. The latter have been achieved largely through automation. The relative decline in employee expenses was a direct result of this increase in efficiency. In 1960, employee remuneration accounted for 35% of total operating expenses of $657 million, compared to 19% of total operating expenses of $3,063 million in 1970.

It is difficult to ascertain the direct benefit to the consumer from this productivity gain, because of the banks' recent emphasis on endeavouring to have services pay their own way in the form of service-charges. However, in view of the experience of other countries, it is safe to assume that had automation not occurred, the costs of processing the ever-increasing volumes of work would have been substantially greater. As new technology emerges, computer equipment has tended to become cheaper, relative to its ability to process work, while labour rates have continued to rise.

Furthermore, the consumer has enjoyed a substantial improvement in the use to which his funds have been put. The turnover ratio (value of cheques cashed/average of deposits) for current accounts and personal chequing accounts has increased from about 65 in 1961 to 116 in 1970. Because demand deposit balances are non-interest bearing, this increase in turnover has reduced the level of free balances available to banks for investment.

Today's bank customer is being billed for payment services more directly, in the form of service-charges, rather than indirectly through unearned interest on capital. This trend toward increasing the proportion of revenue earned through service-charges and fees will continue as consumers become more aware of the time-value of money, and banks become more aware of their unit costs.

4. AUTOMATED CUSTOMER SERVICES

Virtually all banking operations are performed on behalf of its customers. In this context, the term Automated Customer Services (ACS) is taken to mean computer applications performed by a bank on behalf of a customer who could perform these services for himself. In other words, it is not strictly necessary to be a bank in order to perform such a service. Any data involved in ACS belong to the customer rather than to the bank.

At present, most Canadian banks offer an account reconciliation service and a payroll service. These are the major applications, although at least two banks undertake billing for doctors.

Account reconciliation is a logical bank application, because no customer can economically justify the cost of the equipment necessary to read cheques. The service is treated as an extension of regular Current Account Services and consists of reading the customer's cancelled cheques to obtain their serial numbers, then using customer data to accumulate the value of all cheques still outstanding. The total of uncleared cheques is deducted from the account balance and then reconciled to company records in order to verify accounting accuracy.

Payroll is a much-used bank service because it lends itself to standardization as a package. It can be combined with a direct credit transfer to eliminate or reduce the need for cheques. The latter approach can potentially reduce the amount of unnecessary paper and the number of processing steps. The entry of banks into the area of payroll services is not a recent occurrence. They have been using such systems for many years: for example, the preparation of pay-envelopes containing cash.

All of the banks interviewed stated that it was their policy to require every service to be independently profitable. If the costing of these services is accurate, it follows that their prices are not subsidized by other bank services. The ability to offer lower prices than competitors is achieved by economies of scale, and by the efficiencies of internal paperless payment transfers.

Costs are not the primary factor in creating the demand for bank-operated ACS. More important are the following less tangible factors:

- The trust already established between the bank and its customer;
- the financial stability of a bank;
- extensive bank experience in accounting and financial matters, generally, or possibly designed to the customer's specific requirements.

For these, and for other reasons which will be discussed in the next section, Canadian banks seem to be in an excellent position to capture a good proportion of the financial services market. Banks have not yet aggressively tackled this market for two main reasons. First, there is a more urgent need to automate the traditional banking functions, which necessitates the allocation of most resources to internal systems development. Second, the traditional conservatism in bank executive management has been heightened by the losses recently experienced by many U.S. banks in their ACS operations.

5. USE OF COMPUTER/COMMUNICATIONS

During the 1960's, bank computer activities were almost exclusively confined to batch-processing jobs, run on medium-size computers. Computer centres sprang up for local processing in the main cities. These centres still rely on courier services for the physical delivery of documents and reports to and from the branches which are near enough to meet the necessary schedules.

As the range of applications has expanded, bank computer centres have grown considerably larger. To accommodate many applications, and preparatory to going on-line with many of them, the banks are currently switching to large-scale computers.

In order to bring EDP to outlying branches, a beginning has been made in setting up data collection centres in medium-sized cities, such as Windsor. If this develops into a trend, it will lead to a substantial amount of remote batch-processing, requiring medium-speed communication lines. At the moment, the major banks are using medium-speed leased lines between some major cities, particularly Montreal and Toronto.

The on-line savings systems currently in operation use local voice-grade lines. So far as is known, none of these on-line systems yet employ long-haul communication facilities.

Current bank expenditures on computer operations are about 1.5 to 2.0% of operating revenues, and about 1.7 to 2.5% of operating expenses. In contrast, total labour costs represent approximately 19% of operating expenses. Annual expenditure on computer operations in banks is running at about $75 million. The equivalent annual rental for computers used by banks is $10-12 million, excluding data preparation equipment, terminals and computer service charges.

Banks, in total, employ about 600 systems analysts and programmers, and approximately 4700 operations and supporting staff.

Chapter II
Developments in Foreign Countries

A brief survey of foreign developments in automated payment-systems will place Canadian status and developments in perspective. As the world continues to develop into a closely-knit community and international payments are increasingly mechanized, Canada will find it necessary to participate in the establishment of systems, procedures and standards if it is to remain efficient and compatible in relation to other countries.

Several foreign developments in payment-systems provide insight into current trends and the general evolutionary pattern of events. However, foreign developments are not directly translatable into the Canadian framework because of differences in custom, business practice, institutional arrangements, geography, and population density. Thus, this chapter outlines the significant progress that has been made in the application of computers and communications to the payments-system and touches on the problem of international payments.

1. GREAT BRITAIN

British clearing banks are ahead of Canada in the development of on-line banking systems. This situation has some advantages for the Canadian banks because of the experience that can be obtained and applied here as a result of the similarity between the banking systems. One major problem in establishing on-line systems here is Canada's far greater geographical distances, a factor which tends to increase communication costs which, in turn, is an important reason for the time-lag in Canadian development.

The four major London clearing banks are already well into the conversion phase of their on-line systems, with complete automation of their facilities expected by 1973. Even though Britain is geographically compact, there is a tendency to establish regional centres. For example, Lloyd's Bank has computer centres in London and Birmingham, each of which uses two IBM System 360-65 computers. Over 800 branches are now on-line, and all 2350 branches have their work processed by computer.

Over-all, in 1969, banking accounted for 7 to 8% of user-investment in computers — over $130 million. The use of terminal devices has grown to represent about one-third of this total.

To speed up their credit clearing operation, the London Clearing Banks have co-operated in setting up the Interbank Computer Bureau which has since been incorporated under the name of BACS Ltd. (Bankers' Automated Clearing Service). The computer centre receives magnetic tapes, cards or paper tapes from each bank, with details of interbank standing orders, direct debits and bank GIRO credits which must be cleared from one bank's accounts to another. In 1971, approximately 10% of the volume of items cleared between banks entered the automated clearing-centre on magnetic tape instead of paper. When all banks have completed conversion, the production of vouchers will have been eliminated. The clearing banks have also extended this concept to debit items. Customers can send tapes to the bureau, thus eliminating the preparation and handling of vouchers.

There is a trend toward turning in-house computer departments into independent profit centres which offer services to other organizations, at least for automated customer services. Barclays and National Westminister have already entered the general computing service market through specialized subsidiaries.

The British banks have shown a readiness to work together to solve problems of common interest and have benefitted by their co-operative ventures. They are still in competition with one another, and with the Post Office operated National Giro. This is reflected in their individual investments in management systems, bank-card systems and so on. Ultimately, the Inter-Bank Research Organization (IBRO) foresees a merging of the separate bank networks with other functional networks (such as those of the airlines, Inland Revenue and large corporations) into a single national network.

2. SWEDEN

In Sweden, the transition to an integrated electronic payments system was made easier by the existence of a national registration number for each individual, and an operating GIRO payment system. In 1969, most of the Swedish banks formed a consortium to investigate a wholly integrated on-line real-time payments system. This project, called SIBOL, (System for Integrated Payments On-Line), is aimed at reducing the use of paper documents and cash for making payments based on the use of a machine readable bank-card. As a result, it is expected that many people will be released from unproductive work and become available to fill labour gaps in more productive areas.

Planning for the on-line system encompasses banks, department stores, shops, hotels, gas stations and cash-dispensers. Even home terminals are envisaged. The nucleus of this system is expected to be operational by 1975. The SIBOL project is predicated on the expectation that a combination of many independent, and slightly different, on-line systems can never be as effective and economical as one, fully-integrated and standardized nation-wide system. Still, the banks are keenly competitive and have co-operated only because of the pressures of their common problems.

It is interesting to note that although Sweden is a small country of only eight million people, the Saab-Scandia Company has been able to develop a total on-line real-time system for banks. This was developed under contract with a Swedish commercial bank. The system is owned by Saab-Scandia and is being actively marketed. To date it has been sold to several banks in Sweden, Denmark and Finland.

3. UNITED STATES

The banking industry in the United States consists of almost 14,000 separate banks, many of which are small, and serve only a single community or limited area. Due to the large number of banks, most of which are state-chartered, there is a compelling need for intermediaries to act as concentration points

for inter-bank transactions. The Federal Reserve Banks and their fellow-members help meet this need in the 12 Federal Reserve Districts.

The major banks in New York are currently transferring about $25 billion a week in large international payments, using a computerized communication network run by the N.Y. Clearing House Association. The system, called CHIPS, consists of a central B3500 computer and Burroughs TC500 terminals.

So far, it has eliminated 15,000 cheques per week, as well as the messenger service. The system is being expanded to a B6500 computer, to accommodate more banks and terminals.

A Federal Reserve System network serves the funds and transfer needs of the 12 Federal Reserve banks and their member-banks' branches The system is a star-shaped message switching system, using four M-100 communications processors at Culpepar, Virginia, connected via low-speed lines to terminals in the member banks. Activity has begun on a change-over to 2400 baud lines between selected districts, to effect high-speed transmission initially between magnetic tape terminals. This can ultimately be expanded to handle 50,000 baud circuits. Similar networks are, or will be, used to serve member commercial banks in each region. For example, the New York Fed uses two XDS Sigma 5 Computers to switch all intra-region traffic and to act as the local switching centre for all interregion traffic. Wire transfers sent by member-banks are credited or debited to their Fed accounts, thus taking the first step towards a completely paperless payments system.

Bank Wire is a fairly simple store-and-forward message-switching system, operated by 14 sponsoring banks and with about 220 members in 69 cities. It is not as sophisticated as the Federal Reserve System, but does provide an alternate, private service. The American Bankers' Association (ABA) has recommended that the commercial banks act to establish a nation-wide electronic funds-transfer network to compete with the Fed Wire for large dollar transfers.

SCOPE (Special Committee on Paperless Entries) is an experiment sponsored by the San Francisco Clearing House Association, several major California banks and the San Francisco Federal Reserve Bank. For 3 years this group has been developing uniform procedures and format standards which will allow California banks to exchange payment transfers electronically without creating paper at the entry point into the payments system. The Federal Reserve Bank of San Francisco will operate the automated clearing houses on an experimental basis. Start-up was scheduled for the spring of 1972. At least 18 other groups similar to SCOPE have been established in other U.S. centres, notably the Twin Cities Payments Mechanism Study Group in Minneapolis-St. Paul. All of these groups are awaiting the results of the California experiment before proceeding with their own plans. More detail on this project is given in Chapter III, Section 2.

The foregoing are only some examples of developments in the U.S. To provide a broader picture, the American Bankers' Association has conducted a series of studies on the technology and effects of electronic payment systems, many aspects of which are pertinent to the Canadian scene. The main ABA recommendations call for:

- The development of a comprehensive nationwide clearing and settlement system for electronic payments, capable of handling bank, corporate, government and consumer payments;
- development of a nation-wide authorization system based on the use of the bank-charge card;
- increase in use of descriptive billing by bank-card issuers and strong resistance to any legislative or regulatory moves that would inhibit the achievement of this objective;
- continuing research on standards for transaction content and formats, point-of-sale terminals, merchant identification numbers and sales drafts;
- continuous monitoring of the cheque payments, determining new customer needs;
- an extensive industry-wide educational/informational program, to increase the understanding of the need for change by all bankers.

These recommendations should be considered with caution, due to the differing structure of the Canadian banking industry and to differing economic factors. Nevertheless, many of the problems have much in common with those in Canada, and it is to be expected that fundamental techniques will tend to be adopted in both countries. For example, the standard machine-readable credit card and MICR technology was developed in the U.S. and these standards were adopted in Canada, as well as in the U.K. and many other countries. American developments in machine-readable credit cards and associated machinery will continue to have a considerable effect on the formation of international standards for machine-readable techniques for credit cards and identity cards.

4. JAPAN

All major banks are operating on-line systems for intra-bank transfers, but inter-bank dealings still require settlement through the use of older, paper-based methods. Personal payments are primarily made by "money transfers", similar to European GIRO systems. The payor instructs his bank to debit his account and to credit the payee's account. Cheque volume is low and mostly confined to commercial use.

Pre-authorized payments are widely used for all utility bills. Taxes and fixed charges, such as rent and insurance premiums, are planned for inclusion. Point-of-sale purchases are still mostly settled by means of cash.

By 1975, it is planned to have the majority of Japan's 10,000 bank branches connected by an on-line network. Cash for small purchases will be provided by cash dispensers and the growth in the use of credit cards will provide for other payment needs. A nation-wide Inter-Bank System is being developed and is scheduled to start operation in April 1973. This will be a message-switching system designed to handle 1,000,000 transactions per day and will interface flexibly with the already operating intra-bank systems.

5. INTERNATIONAL PAYMENTS-SYSTEMS DEVELOPMENTS

Interest in an automated payments system has crossed national boundaries. Several groups are involved in moving toward automating international payments. These groups are:

The Message-Switching Project (MSP) consists of representatives from 68 banks in 11 countries — 45 European banks and 23 U.S. banks. These banks are considering an international message-switching system, which will first link Western European and later, North American and Far Eastern banks. A feasibility study will be analyzed by participating banks and a decision will be made as to whether the proposed system should be implemented. Canadian banks will be invited to participate by mid-1972, when plans have been firmed up. MSP requires its members not to participate in a competitive system. It is interesting to note that Citibank is a member of MSP. (See MARTI, below)

SIBOL's Swedish, Danish, and Norwegian bank representatives are investigating the possibility of establishing a unified automated payments-system.

Other groups participating are PO/Giro, certain business organizations, such as large department stores, the Statistical Agency, the Central Security Registration Office, the Central Risk Office and a real estate data centre. The central bank has not been involved in this effort.

MARTI is an international telecommunications system for transfer of funds, owned and operated by the First National City Bank of New York. After one year of trial with its own overseas branches, Citibank is now offering this service free of charge to any bank in the U.K. and Western Europe. Since Citibank is also a member of CHIPS in New York, a payment-transfer, remitted in the CHIPS-MARTI mode, can be received and executed in a matter of minutes by the receiving bank of New York. The system can be used for automatic transfer of payments by the following method: The European bank would prepare the standard MARTI transfer payment form and transmit it by Telex to the MARTI centre in London. The London Centre feeds the payment instruction into the Citibank payment processing centre in New York, which in turn feeds the information directly into the CHIPS System. Citibank has presently 28 subscribers to the system and expects that "several hundreds" will join eventually.

American Express International Banking Corporation announced its plans to set up an international communications network, largely through the use of satellites, to expedite control of its world-wide money operations. The objective is to link major foreign exchanges and money centres throughout the world on a "rolling account system". The system would be operational 24 hours a day, to switch the unbalanced portion of the European account to New York. As the day progressed, the unbalanced portion of the North American account would be switched to Asia, then to London and Europe and so on. The company hopes to virtually eliminate idle balances.

The Board of Governors of the *Bank for International Settlement* (BIS) has been requested to set guide-lines for central bank and BIS participation in developing a single, integrated international payments network. This request was made by a group of central-bank computer experts who had noted the activities of various organizations in the international payments field. They also took into consideration the fact that the existing multi-lateral telephone communication system between five EEC central banks could be developed into a message-switching and/or payment-order system. It was felt that several non-compatible international networks may develop, some of which might exclude central banks.

Chapter III
Future Automation of Payments and Credit

1. DEVELOPMENT OF AN ELECTRONIC PAYMENTS/CREDIT SYSTEM

A financial network for payments and credit in Canada will almost certainly be built around on-line banking systems. Key prerequisites of a fully-integrated system include:

- A machine-readable identification card with a built-in means of verification;
- a system of pre-authorization for repetitive payments;
- an on-line terminal at each place where payments might be made;
- an established line of credit for all customers.

Since these components are not yet operational to the required degree, it is necessary to examine the progress being made in each one in the light of today's situation regarding funds transfer systems.

The Chargex card, currently offered by four Canadian banks, might just possibly be the starting point for a "universal" payment card, by providing for electronic funds-transfer. However, a number of developments must occur before this card will meet the necessary requirements:

- The existing embossed card would have to be re-designed into a machine-readable form. A standard for embossed cards, together with a standard numbering scheme for issuing identification and a standard registration procedure has been developed, and will shortly be placed before the members of ISO for their acceptance. A Working Group of the Subcommittee on International Standardization of Credit Cards is currently developing draft standards for machine-readable techniques on credit cards and identity cards. Another Working Group is developing standards for identity cards. The Canadian Standards Association is deeply involved in the ISO Sub-committee, since its main representation consists of members of the Canadian banking industry.
- Although the standards being developed are not restricted to one particular technique of data recording, it is worth noting that the dual-density magnetic stripe (on the back of the card) appears to be the most common method in use at the present time. This technique has been endorsed by the ABA and several types of terminals are now being manufactured in the United States that will be capable of reading this type of card.
- The incorporation into any card of some feature that would allow verification of the card-holder's identity. While such a feature would not be strictly necessary to the making of payments electronically, it would be needed to cut down on the increasing use of stolen cards and other fraudulent activities. The most feasible technique at the moment appears to be the use of an embedded photograph and signature of the card-holder on microfilm, which is only visible when inserted in the proper terminal device. More remote possibilities include voice and finger-print analysis, performed on-line by a computer.
- The Chargex franchise will have to be extended to the other Canadian banks which are not at the moment offering the card. The Canadian franchise (from Bank Americard) is not exclusive and the other banks may join if they wish. While it is possible to conceive of another bank charge card in use in Canada, the probability seems slight, since there do not appear to be any significant competitive advantages. Extension of the Chargex system to other banks seems more likely, in view of the need of the non-participating banks to remain competitive in this new method of handling consumer-payments.
  It is interesting to note that any technical developments in the card or the use of it are probably available to the Canadian franchise-holders, as well as to those in other countries such as Barclay's Bank in England and Sumitomo Bank in Japan. Thus the prospect of an international card is already beginning to take shape.
  Increase in bank credit card coverage to a majority of individuals and merchants. As of the fall of 1971, there were somewhere in the region of over 52,000 merchants registered with Chargex, and approximately 2.2 million (or more) card-holders throughout Canada. The exact rate of growth is difficult to estimate because of the trend toward eliminating inactive accounts. Nonetheless, it is apparent that the card is gaining

acceptance, even though reasonably full penetration will require a number of years. At the moment, the credit-rating requirements of Chargex exclude many individuals — about 50% of the applicants are rejected. In time, it is expected that this problem will be solved by improved verification and authorization techniques, based on the use of enquiry terminals.

- As implied above, the acceptance of bank cards by the independent retailers, and petroleum companies, has already begun to take place. Recently, several major accounts have signed with Chargex, including Gulf Oil, Texaco, and several junior department-store chains. It is regarded as only a matter of time before most major retail organizations will accept banks' cards, either in parallel with their own, or exclusively.

A machine-readable payments card could evolve in either of two directions. One would be through the development of a "money" card, which would have a pre-recorded amount, systematically decreased with each successive purchase until exhausted. At this point the card would have to be recharged with money. This method could be efficient in some situations, but for the purchase of large items it would necessitate payment in full, and many customers would prefer a credit option. In addition, there would be more security problems with this type of card, inasmuch as the card itself would represent money.

The other technique would be a machine-readable card which would rely on access to a computer for credit authorization and the transfer of funds from buyer's account to seller's account. This type of card would be more flexible, in that it would serve only to identify the customer and activate the terminal device. An important feature of such a system would be the credit component. In fact, it would be preferable, from the customer's point of view, to make his payment by sending payment instructions to his bank. If such a method was implemented, the merchant would have no way of knowing whether or not his customer had the cash or was using bank-credit. It seems probable that the latter approach will gain wide acceptance because of its greater flexibility. Ultimately, such a payments card could be used for most large-item purchases as well as to obtain cash for small purchases, in many cases from automatic cash dispensers. Such frequent use would obviously place a heavy demand on bank processing facilities and would demand paperless technology to achieve reasonable costs. Ultimately, of course, a customer's bank-card activity would have to be integrated with his other banking operations to allow automatic transfers and single statements.

2. PRE-AUTHORIZATION

Pre-authorization refers to the automatic initiation and processing of debits and credits on behalf of customers by a bank. This technique, which is now commonly used for fixed-amount loan and mortgage installments, has a large potential for reducing cheque-flow through such arrangements as:

- Automatic payroll deposit;
- dividend and interest payments;
- social security, pension and welfare payments;
- automatic crediting of rental income;
- payment of repetitive charges such as telephone CATV, electricity, and other utilities;
- payment of credit card charges.

Pre-authorization is possible now in Canadian banks through use of the Pre-Authorized Payment Plan. Most users are large corporations, who obtain the right to draw on an individual's account by means of power of attorney. Substantial savings can be realized by this technique, compared with the normal method of making payment by a cheque drawn by the payor. However, the system is still paper-based, in that it is necessary to produce vouchers in support of each entry. When this paper can be eliminated, the reduction in handling costs will result in reduced charges for processing pre-authorized payment instructions and greatly increased usage. To reach this stage, three steps are necessary:

- The development of standards for the encoding of payment transfer instructions in electronic or magnetic form;
- the acceptance and use of these standards by all banks;
- customer and auditor acceptance of the entry without a supporting voucher.

To this end, the Canadian Bankers' Association, together with the chartered banks, has developed a set of standards which will enable payments information to be received on magnetic tape and exchanged between the banks by the same medium. These standards are close to finalization. It is interesting to note that some corporations now submit payroll instructions to their banks on magnetic tape. But the bank must then prepare documents in order to make use of the inter-bank clearings system. As a first stage in eliminating documents, payment instructions will be transferred on magnetic tape and eventually by direct transmission.

Once underway and given some promotion, use of pre-authorization for paying repetitive bills will grow quickly. Some of the advantages in addition to the reduction in cheque volume are:

- Ability of banks to ''smooth'' workloads;
- improved cash-flow projections;
- individual relief from cheque endorsement and deposit/cashing problems;
- less money tied up unproductively ''in transit''.

To gain some idea of the potential, with a Canadian labour force of 8.5 million which has an average pay frequency between 35 and 40 times/year, payroll deposit plans alone could eliminate about 400 million cheques. Using an average cost of $.50 per payroll cheque, the potential savings per item could reach $.35 due to elimination of cheques, postage, handling and reconciliation. This indicates a potential cost-savings of $140 million.

To establish the legal, procedural and acceptance requirements of a large-scale pre-authorization system, there are several experiments now underway in the United States. The most ambitious of these is the SCOPE Project. Participants include the Federal Reserve Bank of San Francisco and many private banks in California. The banks will send debit and credit entries to their automated clearing house by magnetic tape, punched cards or data transmission. There will be no accompanying paper documents. Initially, plans call for converting only 15% of the cheque transactions amenable to pre-authorization, mostly payroll cheques.

One of the conditions governing the SCOPE Project is that participation is to be offered to all California banks and at least 150 of them have indicated interest in the scheme. The programs and techniques are to be made available to other SCOPE groups.

3. LINE OF CREDIT FOR INDIVIDUALS

The basic need for a line of credit arises out of the convenience of granting credit automatically if the payor or buyer does not have enough funds in his account.

The beginnings of this can be seen today in the Chargex card and various cheque-guarantee plans. Each card-holder has a financial limit, which he is not supposed to exceed, for all purchases made with the card. However, the line of credit referred to here would apply to all the individual's financial transactions and would be based on such factors as personal assets, reliability and salary.

This could save a lot of unnecessary time and investigation on each occasion an individual wants credit. A limit is established for him, through an evaluation/rating procedure, and is stored on-line by a computer for reference when it is needed. This is just an extension of the familiar management-by-exception concept. In practice, it might also work as an automatic account overdraft facility.

4. ON-LINE RETAIL TERMINALS

If payment for goods and services is to be made electronically, then there must be a terminal device at the point of sale to generate the payment instructions to the computer and to record or transmit details of the transaction. Extension of the requirement leads to a nation-wide network of retail terminals. The technology is moving towards such a network, but development will be held back chiefly because of high costs and an immediate lack of urgency for the introduction of new methods. How, then, might such a Point-of-Sale (POS) network develop?

In the large department stores and retail chains POS systems through authorization terminals will come about as a result of the desire to reduce credit losses. This will lead to the use of the same terminals to capture sales data for management reporting, inventory control and accounting. Already, some major department stores in Toronto are making limited use of credit authorization terminals. Some large chains in the U.S., like Montgomery Ward, have placed orders for thousands of POS terminals. The fact that IBM now has a POS terminal will mean a major marketing push. After many false starts, point-of-sale systems appear on the verge of rapid growth.

For small and medium-sized retail outlets unable to afford their own systems, there are plenty of enterprising firms which will be willing to provide the service. Promising candidates are the banks, for the simple reason that they can provide many other terminal services as well. At present, the most

probable course of development appears to be the introduction of inexpensive retail terminals for the purpose of credit authorization. These terminals are likely to be credit card reader attachments to touch-tone telephones. Once installed, the terminal begins a natural chain of progression, starting with the entry of the amount of the sale by a clerk, followed by carrying out the payment transfer and ending with the input of stock codes, invoice receipts, and other items which would allow the production of sales and inventory reports. Such a service, when it becomes available, will place the small independent merchant in an improved competitive position in relation to the large merchandiser.

As we have seen, the key to this system is the machine-readable payments card. Up to this point, credit card plans have helped hold down the cheque flow by implementing one cheque service to settle a number of accounts. But credit card sales slips now cost more to process than cheques — about $.45 versus $.135. The real promise for the future lies in the great potential for savings which will be possible if the credit card can be made to generate electronic commands to a computer, and paper-processing is no longer required. It is estimated that with such a system the cost per item will fall to less than $.10.

Many transactions today are handled by using cash — probably from 30 to 50 times as many as are made by cheque or credit card. Obviously, in the foreseeable future, the banks could not handle this volume. Cash will remain the primary method of payment for small-item purchases and in situations where terminals are not feasible. When payments are made by card, a delay in the actual debit to the customer's account will probably be inescapable. A standard time-delay might be incorporated to allow for enquiry or return of merchandise.

The procedures, problems, costs and effects of an electronic funds-transfer system for retail payments can be determined only by actually building such a system and testing it on a large scale. This is currently being done in a number of places in the U.S.

One of their major experiments is Omniswitch which began in the summer of 1971. The test involves the New York banks that offer Master Charge, including the First National City Bank of New York and Manufacturer's Hanover. Initially, terminals were installed on merchant premises for use in credit authorization. The system verifies that the card is not stolen and that the customer has not exceeded his credit limit. This experiment is particularly significant because of the stature of the banks involved.

Another U.S. experiment is being tested in Upper Arlington, Ohio, by the City National Bank and Trust Company of Columbus and National Bank Americard Inc. This six-month experiment started October 11, 1971, and is designed to test the procedures, the effect on participants, the convenience, and the economics of electronic payments using dial-up telephone terminals with a credit card reader terminal.

These experiments demonstrate the technical feasibility of electronic payments. The main problems to be investigated are the practical difficulties of implementation, the reaction of customers and merchants and the economics of the operation.

Of course, there are many other components to a complete payments/credit system — data files, programs, processing equipment, etc. and many technical problems to be solved before such a system can become operational. Among the major considerations are:

- Universal customer-identification and account numbering;
- data security;
- reliability;
- audit requirements;
- file organization;
- equipment selection;
- communications network configuration;
- system and application software;
- standards for system interfaces, transaction formats.

A comprehensive description of the above factors would require volumes. All are currently being studied by the banks in the course of designing and implementing their own on-line systems and will be resolved in due course. One of the advantages of the separate developments taking place is that a variety of possible solutions will be tried, eventually resulting in the discovery of the "best" approach, only obtainable through experimentation, trial and error.

5. ON-LINE BANKING NETWORKS

All of the Canadian commercial banks are actively planning for and developing on-line systems. According to a review of current plans of the national banks, there should be 3800 to 5000 bank branches on-line by 1977 (about 60 to 70% of the total branches) for at least one major function.

Plans are necessarily tentative, and are certain to change as a result of delays in equipment deliveries, cost changes, competitive forces and systems-design changes. Another variable is the number of banking applications that will initially be implemented as on-line applications. All on-line branches will have access to deposit accounting and enquiry services, which account for the greatest transaction volume. Loans and other applications can be added later. In any event, the systems to be installed are designed to support the full range of bank service applications, in the sense that these applications can be added without requiring fundamental re-design of the system.

Initially, the bank central processing systems and terminal networks will be developed and operated independently. The network growth pattern will originate in the major cities, particularly Montreal and Toronto, and will spread outward as economics and logistics allow.

On a coast-to-coast basis, major differences in network shape among banks can arise from different concentrations of branches, leading to different patterns of concentrator location and mainframe location. Various design

strategies are also sure to emerge. For example, some banks will perform all processing and will store all files in one central location to benefit from economies of scale. This is probably the least expensive approach from a computer hardware standpoint. Other banks may opt for two or more mainframes in different parts of the country. The latter approach saves data transmission costs, improves system reliability and allows some regional variations to occur in the operation, by virtue of the proximity of the processing centre to the area being served. Specific configurations are naturally based on minimization of communication cost, subject to meeting system objectives, in relation to the geographic dispersion of branches for each individual bank.

For real-time applications, the response time must be fast, because the customer is waiting across the counter. Most of the data to be transmitted are in the form of short transactions, averaging perhaps 20 characters in length, and the volume of these transactions is high.

A number of branch-banking terminals are on the market and include such components as alphanumeric keyboard input, special-function keys, error indicator lights, a journal recorder or printer, a voucher or passbook print mechanism and CRT display. IBM is currently dominating this market with variations of their 2970/2980 teller terminal system. However, NCR, Burroughs, GE-Honeywell and Olivetti have also introduced banking terminals, some of which are in limited use in Canada as on-line savings terminals.

It should be kept in mind that the banks will still be processing large numbers of cheques for many years to come. Up until the late 1970's, cheque-volume is expected to continue rising. After that, the number of cheques issued will probably level out and then decline. The significance of this is that cheque-handling — collecting, reading, sorting, cancelling, processing and returning or storage — will continue to be a major activity, largely independent of the operation of the real-time systems. In order to handle the over 2 billion cheques per annum which is expected in 1977, the banks will need pick up and delivery services, MICR reader-sorters and encoding and proof equipment. The capture of payment instructions from cheques, in a form suitable for data transmission must be performed locally to minimize the "in transit" time. Courier services have a limited practical range if cheques received during the day are to be processed that night. Hence, to handle the expected volumes of cheques, regional batch-data preparation and entry centres will be required throughout the seventies. In major centres, concentrators can also double as batch-entry computers. In smaller urban areas, small-scale computer installations may be used to input transactions of local origin, and to print high-volume branch reports.

The Royal Bank of Canada is already experimenting with this concept, using a small computer in south-western Ontario. Concurrently, the CBA, with the banks, is evaluating a shared network for use in medium-sized cities to improve the flow of payments data.

Authorization of a credit sale is initiated by a merchant and cannot be classified as a branch-banking application. Currently, merchants seek authorization for individually charged sales which exceed an established ''floor limit''. Chargex purchases over $50 are checked by telephoning a local authorization centre. Most of these are manual operations, although the Royal Bank in Montreal has used centralized remote CRT inquiry for over two years.

This retail application will probably develop in two stages:

- Growth of centralized remote CRT inquiry, using telephone operators in major centres;
- direct retailer inquiry, using Touch-Tone telephone with a credit-card reader attachment or separate terminal.

It should be noted that both Eaton's and Simpsons have already reached the second stage with the installation of credit authorization terminals in their main Toronto stores.

The second stage will set the scene for a number of other retail applications and will eventually contribute substantial transaction volume to local telecommunication facilities. Payment Systems Inc. of New York, estimates that about 6 million terminals would be required for the merchandising business in the U.S. This indicates considerable potential for retail terminals in Canada.

Development costs are extremely difficult to estimate. Inasmuch as the planning, development and implementation of on-line systems can take from 5 to 7 years from the start of work, many technical and production developments can significantly alter costs. Since many of the problems that must be overcome are new, estimates can be made only on a very approximate basis.

Total development, conversion and operating costs of an on-line banking system over the next 5 years will cost each bank approximately 100-200 million dollars. For the 5 largest commercial banks, this represents a total investment of $500 million to $1 billion.

As has been mentioned earlier, Canadian banks are strongly competitive and are convinced that computer technology is perhaps the most important tool with which to improve their market position. For this reason, plus the tendency of systems-managers to believe in the superiority of their particular approach, there is little likelihood of Canadian banks sharing programs or computer usage in the next few years. Thus, there may be some redundant programming and systems work (and costs) before a spirit of co-operation sets in. Co-operative efforts are appropriate in some areas, and the Canadian Banker's Association is working toward this end. However, the situation cannot be forced. The likelihood is that the competitive approach will stimulate the process and will lead ultimately to a complex electronic funds-transfer systems.

6. AUTOMATED CUSTOMER SERVICES

In the context of computer services, since much of the financial data of customers will flow through the financial computer centre, the bank will be in a position to maintain customer accounts, perform financial cash-flow analysis, help the customer plan the best means of meeting his financial needs, extend credit and plan his surplus funds investment program. These services may become bank services, for when a bank has a well-designed payment system, the bank's computer could provide these services at a lower cost than that which the customer could achieve by himself. There are several reasons to expect this bank efficiency:

- The existence of a large-scale, specialized bank computer processing system;
- the data used will be a by-product of the bank payment transfer system (leading to fewer intermediate processing steps and reduced document handling);
- banks will have specialized data and techniques (*e.g.*, economic research, econometric models);
- the existence of a country-wide network of branches.

It is apparent that not only the technology, but the nature of payment systems is changing. For some of today's customers, a payments service means a complete range of related activities — from point-of-sale data collection, to billing, to collection and to receivables accounting. To complete the picture, the payer's end of the transaction also requires payables and cost-accounting.

In recognition of these factors, the Federal Reserve Board in the U.S. recently changed their regulations in order to permit one-bank holding companies to offer data processing services to their clients, but to limit operations to processing of banking, financial or related economic data — such as payroll, accounts payable/receivable, or billing. It also allows excess computer time to be made available and the furnishing of any EDP service upon request, if not otherwise ''reasonably available'' in a market area.

In fact, the restrictions imposed are hardly necessary. Those U.S. banks which have ventured into other applications, such as classroom scheduling, have almost invariably lost money. Banks have lower marginal costs when processing financial data and their experience is relevant. But they do not have any such inherent market advantages in non-financially related applications. For this reason, plus the fact that the financial market offers plenty of scope, it is unlikely that banks will attack the non-financial computer services markets.

Market areas likely to be considered by the banks for ACS are as follows:

- Account reconciliation;
- payroll;
- pre-authorized payment plans;
- credit authorization;
- retailing package (accounts receivable accounts payable, inventory, sales-analysis, management reports);
- other industry specialized accounting/MIS packages;
- financial analysis (portfolio management cash-flow analysis, financial planning, modelling);
- OCR data preparation;
- billing and accounts receivable for doctors, dentists, etc.;
- credit evaluation.

Broadly speaking, a bank's market for ACS is primarily the small and medium-sized businesses, particularly retailing. Large companies usually have enough in-house expertise and computer capability, although they will also use services like account reconciliation. Retailing is a particularly good market for bank services, because of the short control cycle and the importance of tight financial control. Manufacturing has fewer sales and does not allow the same opportunities for financial integration.

The credit authorization market was generated from the need to verify that bank card purchases are within the customer's credit limit and that the card is not stolen. Again the retailing industry is the major user. Credit authorization leads the banks into the sale of retail services. It appears unlikely, however, that Canadian banks will be in a position to provide retail accounting/ reporting services via a POS terminal network by 1975. In that year, to the extent that retail services are provided, they will probably be offered on an off-line basis.

The potential for OCR data preparation centres is uncertain. So far, only the Canadian Imperial Bank of Commerce is in the market, but their Commerce Optimations Services Ltd. in Toronto appears to be a success. Certainly, when the banks offer off-line services to merchandisers and small business, they must have a method of data preparation and OCR seems a reasonable solution because it has an application in reading sales drafts. In any case, OCR data preparation charges would probably be built into the overall fee schedule for a total bank service.

Individual credit is evaluated by banks when granting loans or issuing bank-cards and courtesy cards. To obtain the necessary information for other than the banks' own customers, credit bureaux are one of the sources of information. It is entirely possible that banks building Customer (or Centralized) Information Files (CIF's) will find it cheaper and more convenient to store their own accumulation of historical credit data on their customers. As more consumer credit is extended by banks, they may become the primary source of most credit/financial data. Thus, it is likely that alone, or in tandem with existing credit bureaux, banks will find themselves in the credit evaluation market. However, since there are no known plans at the present, it would be unrealistic to attempt a prediction of their penetration of this market.

Up to this point, much of the effect of bank automation has been dissipated by the necessity of keeping pace with the ever-increasing demands placed on the industry by an expanding economy. Most efforts of banks and programming people are still concentrated on building systems for internal use. As the internal development work peaks and starts to fall off in any bank, the experience of analysts and programmers will find its best application in the development of automated customer services. Already the banks are experiencing a growing demand from their customers for the provision of additional services.

It is therefore likely that the systems which will be first developed will be those which meet a known customer demand and will be initially designed for off-line processing. By 1976, the banks probably will have completed a

number of customer-service packages, in addition to those of payroll and account reconciliation. Among the ones most in line for early development are accounts receivable, accounts payable and billing. The packages will be industry-oriented and modularly constructed, to allow limited customization. Without exception, all the banks interviewed have a policy that all services must be self-paying. It follows, therefore, that any computer-services offered will be unit-priced and will be expected to make a profit. Naturally, there are difficult cost-allocation problems, but these are being pursued. Canadian bankers are aware that a major reason for the losses suffered by many U.S. banks on ACS was due to incomplete knowledge of the cost involved.

7 ESTIMATED SCHEDULE

As a result of the overall survey, it appears that certain specific events and trends may occur within the following time-frame.

YEAR	EVENT AND TRENDS
1971-75	• Intensive period of on-line application development. • Internal bank operation of on-line savings systems in all major cities: development of parallel functional data transmission networks. • Limited implementation of on-line DDA, loans, securities and other internal applications. • Inter-bank exchange of payments data on magnetic tape. • Introduction of optional non-returnable DDA cheques. • Increased automation of regional bank credit authorization centres. • Experimental use of machine-readable bank-cards. • Increased use of direct credit for payroll, and dividend payments. • Expansion of bank services to include automated billing, accounts-receivable and accounts-payable. • Inter-bank settlements, handled primarily by direct data transmission.
1976-80	• Most domestic bank branches directly linked to a computer. • Co-operative bank arrangements to share data communications network facilities. • Direct data transmission between banks and the computers of large corporations. • Point-of-sale systems, operative in large department stores for credit authorization and capture of sales and order data which will be linked to banks. • Pre-authorization commonly used for fixed repetitive payments. • Widespread use of bank-cards for payments.

- Development of Centralized Information Files by banks to integrate customer financial status.
- Experimental direct links with foreign banks for international payments.
- Direct interconnections between banking systems and government networks for National Revenue-Taxation Customs & Excise, Department of Supply & Services, Bank of Canada. Some on-line services available to bank customers, particularly small retailers and wholesalers.

1981-85

- Rapid growth of financial network participation by retailers and other businesses using on-site terminals.
- Decline in use of cheques for personal and commercial payments, resulting in increased financial network transaction volume.
- Extensive use of international data links for financial and trade transactions.

Chapter IV
Constraints and Problems

This chapter attempts to outline some of the factors that inhibit the development of an electronic funds transfer and credit system in Canada.

Banking is by tradition and practice one of the most conservative of professions. Therefore the reluctance to alter established practice and habits constitutes the main restraining influence on the development of an electronic payments/credit system. This conservatism manifests itself in both the purveyors and users of financial services. Its effect is felt not so much in active resistance to new methods as in a feeling that existing methods are adequate and that new techniques will not attract a significant amount of new business. For example, many bank customers would strongly disapprove of a move to stop the return of their cancelled cheques. Aware of this public attitude, many banks might be wary of initiating such a step, for fear of losing their customers. Similar considerations apply to savings-account passbooks, direct crediting of pay, and automatic deduction of pre-authorized payments.

Rather than introducing new methods on an all-or-nothing basis, the banks will almost certainly offer them as options. Promotional campaigns will stress the convenience and speed of the new methods and the less conservative customers will accept the change. Ultimately, acceptance will grow, and will be encouraged by cost-incentives. If a telephone bill in 1980 can be paid on a pre-authorized basis for 7 cents, but the service charge on a cheque is 25 cents, there will be an incentive to reduce the number of cheques being written. Certainly the future holds many changes for the carrying out of commercial transactions. To some extent, the introduction of these changes will be delayed because of the lack of apparent customer interest. A marketing study by the Marketing Task Force of the ABA Monetary and Payments System (MAPS) indicated that the public is satisfied with the present use of cheques and most segments of the population see some disadvantages in any change to established systems. However, the changes are bound to come — pushed by cost considerations rather than pulled by customer demand. Once they are established, they could grow rapidly. The disruptive effects should not be serious since the changes will probably be gradual and will be opted for by customers rather than being forced upon them.

If, over the next ten to fifteen years, an electronic funds-transfer system is going to largely displace the bank cheque, it will be necessary to modify the existing laws. These are now predicated on the use of bills of exchange as payment instruments. In the future, a new legal framework for commercial transactions will eventually become necessary. A study has already been conceived and planned by the University of Toronto Faculty of Law. Some of the specific problems are discussed below.

Cancelled bank cheques now have legal documentary status as proof of payment. In order to eliminate the need for returned cheques, or indeed to have cheques at all, the courts must be able to accept bank statements or transaction print-outs as documentary proof.

In certain circumstances, certified cheques or official cheques are needed, to prove that the payor has the necessary funds. If the transfer of funds can be completed electronically, the need for such proof will be eliminated.

When funds are instantly transferred by electronic means, there is no longer any need for a stop-payment, except in the case of payments that are pre-authorized and are automatically initiated. To allow for the return of merchandise or refunds, due to inadequate service there will also be a need for a flexible transaction reversal mechanism.

There is currently a legal requirement to present a cheque before receiving payment. This would have to be changed to require *only* the presentation of the payment instructions — *i.e.*, in electronic form. Presumably, these instructions must be presented in a standardized format with unique and legally acceptable identifications of the payor and payee.

Current requirements pertaining to the examination and audit of financial records, which demand vouchers supporting accounting entries, must be updated. Again standards must presumably be established to ensure consistency.

Changes may also be needed in the law affecting the amounts and kinds of credit information that can be maintained or disclosed regarding a given customer. Too restrictive laws regarding access to personal data might severely encumber companies engaging in consumer credit. Nevertheless the consumer must be afforded protection.

Although entry into banking *per se* is subject to many conditions, there is no law to prevent quasi-banks from offering payment-transfer services. Theoretically, at least, a variety of different organizations could be active participants in an on-line payments/credit system. But, for a number of reasons, the commercial banks are in a strong position to lead the development of an electronic payments/credit system. They already form the hub of our payments system, and they have the money, the experience, the branch networks and the customer base necessary for expansion.

Competition in payment-transfers could arise from trust companies, finance companies, large retailers, common carriers, computer manufacturers, independents, or even government. In view of the profit potential of secondary markets for financial services (*i.e.*, financial services ancillary to payments), some firms are expected to attempt to break into this field. While it is true they would face strong, entrenched competition, these firms will be studying the progress of bank automation and market strategy. Significant delays by the banking industry would almost certainly lead to increased competition for payment-transfer services.

There will be a continuing need for credit evaluation services — a need which is now met by independent credit bureaux. If the bureaux act to mechanize their information files to meet the cost and speed of retrieval

requirements of the future, they will become active participants in the financial network. Otherwise, the banks will tend to build their own customer credit-rating files, thus reducing their dependence on credit bureau services.

Government will undoubtedly have a strong interest in an emerging electronic payment/credit system — as a user; as manager of monetary and fiscal policy; and as custodian of the public interest.

In brief, the electronic payment/credit system will likely develop by the merging and interconnection of separate networks, credit and retail sub-systems and service bureaux. While loosely referred to as a "network" or "system" the mechanism will, in fact, be a coalition of overlapping sub-systems.

Institutionally, the nucleus for this "network" will develop out of the independent on-line banking systems and will thus be assured of Canadian ownership, control and financial stability. This is the path already embarked upon, and the one that will create the least resistance. There may be strong contenders for this leadership from other economic sectors. And this, combined with competition among the commercial banks, should result in a stable, efficient network of services with a sufficient number of options for the customer.

There is no shortage of people with technical skills in conventional systems-design, programming and project management for batch computer applications, although many of these individuals generally seem to lack the necessary broad knowledge of business practice and communications skills. There is, however, some shortage of people with skill and experience in the design and implementation of commercial real-time systems and in the management of very large computer projects.

This shortage of experience with large real-time systems is simply due to the fact that few such commercial systems are yet in existence in Canada.

When the Bank of Montreal's plans for an on-line, real-time banking system were unveiled in 1969, the proposed system was the largest of its kind in the world. Clearly this meant a lot of ground-breaking activity. However, it is only by means of such projects that the necessary experience can be gained.

The development of banking computer/communications systems will depend upon the availability of suitable hardware from the computer industry, and upon the development of data networks facilities by the common carriers. Costs for major hardware components, such as mainframes and memory, have reached acceptable levels, and further cost-reductions are probable. Terminals for banking networks are still evolving and their characteristics and quantity requirements have yet to be completely established. Plans for network developments by the carriers are discussed in Volume I. Software and systems-management concepts are as important as the hardware required for the systems, and are probably no further advanced. There is much to be done in both application systems-analysis, and hardware and software standardization.

For banking on-line systems, two general patterns are possible. These are:

- A separate functional network for each of the five major banks, or;
- a single functional network shared by all of the five major banks.

In either case, the carriers could provide the communications facilities. Supply and ownership of terminals will depend on the competitive situation.

At this point in time, the banks have opted for separate functional systems. A prime consideration for doing so is that each bank requires a freedom to develop its own system in its own way and at its own rate.

This freedom is important, because each bank has different priorities in automation — in terms of both degree and speed of implementation. Co-operation would require agreement on priorities and would imply roughly equal rates of development. Because automation may be a significant competitive factor, those banks which are ahead in the race are not inclined to mark time while waiting for the others to catch up.

On the other hand, and distinct from the on-line systems, the banking community recognizes the need for improved methods of cheque-handling. This will continue to be an off-line data collection and processing application for the next decade or so. Inter-bank co-operation in this area is commonly accepted, since roughly 80% of the cheques received by one bank are drawn on other banks. It seems more likely that agreement will be reached in the operation of an "automated clearings system", even if this only amounts to a standardized interface between bank computers, rather than the operation of a separate facility.

Through the CBA, transaction format standards have been developed for use by all banks, and a study of the feasibility of regional information collection and distribution centres has been initiated with representation from all the banks.

If transit times are to be reduced, the alternative to the above-mentioned regional information collection and distribution centres is parallel operation of many regional batch centres by the various banks. These batch centres would MICR encode cheques, sort them, translate them into magnetic storage media, and transmit the payment instructions for processing elsewhere. Again, current developments seem to indicate separate bank operation of these cheque-processing facilities with interchange of payment data between banks, first on magnetic tape, and then by direct transmission. However, it is conceivable that the economies of shared cheque-processing facilities will induce the banks to closer co-operation. There is precedent in their common adoption of MICR encoding standards.

In terms of regional development, it is evident that the major centres of population and financial activity offer the greatest returns on investment in automation. The cost of data communications to remote bank branches is high and still leaves the cheque-handling problem unsolved. For these reasons, it is to be expected that the remote bank branches will be the last to be connected to the on-line banking networks. Nevertheless, while the marginal cost of automating these remote branches is high, it may eventually turn out to be less than the cost of non-automation. And, as soon as the on-line systems grow to the stage where the remote branches must be treated as exceptions in cheque-handling, accounting and reporting, the pressure to "round out" the system will be great.

The remaining problem area in financial data communications is that of network services for customer applications. It has already been pointed out that there is a substantial future market for financial services that could be met by the banks, especially in the retailing industry.

The on-line systems being developed are designed for internal bank operation and are not intended to carry a significant volume of customer data. This would appear to indicate a lack of any specific plan to input customer data through branch terminal facilities.

In fact, the banks currently have not, or at any rate have not disclosed, any plans to offer general business services, *i.e.*, financially related services, such as accounts-receivable, on an on-line basis. To the extent that these services are made available in the next few years, it must be assumed they will be offered as batch-processing services. The need for complementary data preparation services, remote job entry (RJE) and report printing makes the case for individual bank regional RJE centres more attractive. Indeed, where OCR equipment can be used instead of MICR equipment, it can double up for use in reading cheques and customer data.

Chapter V
Benefits and Effects

A study performed in the U.S. has shown that a doubling in the level of national economic activity requires an increase of from two to five times the current level of financial transactions. These increases cannot be supported by the present paper-based methods of payments.

In Canada, the situation is probably not as critical as in the U.S. Nonetheless, it is still true that the cost of the payments/credit mechanism would increase at a rate faster than the rate of economic growth, if changes were not being made. It is clearly in the national interest for Canadian banks to take the initiative in holding down these costs through better technology, thereby ensuring that Canadian financial mechanisms are as advanced as those developing in the rest of the world.

The reduction of the "in transit" time of money may have some effect on the day-to-day financial practices of business. Some firms today use "float" as a significant part of their working capital, by speeding the collection of receivables and slowing the disbursement of payables as much as possible. It has been estimated by the Canadian Bankers' Association that the average in-transit time has been halved over the last 10 years. Specific figures are not available, since debit float and credit float are jointly reported as a net figure. In any case, it is reasonably certain that electronic funds transfer will cut both the "in-transit" time and the float to zero for many transactions.

The banking community is well aware that faster and improved methods of cash-flow management would lead to acceleration in the rate of deployment of capital for expansion, and improved customer services.

As was stressed earlier, the increasing reluctance of corporations and individuals to maintain high deposit balances means a shift toward more direct costing and charging for unit banking services.

An automated financial system will eliminate many of the time-lags inherent in today's paper-based systems. In terms of economic analysis and forecasting, more accurate and complete data will be available more quickly. Changes to the bank rate, and other determinants of monetary and fiscal control, will have a more immediate effect on the system than is the case today. Thus, the potential for a better understanding and a finer tuning of the economy provides the possibility of yet another benefit as a result of automation.

Credit will continue to expand due to improved evaluation methods, lower costs of administration and more customization of services for specific customer groups or individuals. Better methods of controlling and recording credit transactions should also lead to a reduction in the costs of extending credit — e.g., the level of merchant discounts. For most of a consumer's needs, credit will eventually be extended automatically, based on an individual's record for credit reliability and ability to repay.

On the other hand, new types of enterprise may arise to take advantage of new markets created by the changing technology. Perhaps a forerunner in this regard is National Data Corp. (NDC) of Atlanta, Georgia. NDC has established

a computerized credit card authorization service for most of the major oil companies. It currently serves several of the Canadian oil companies. Recently, NDC began taking over the payments system (*i.e.*, billing through collection) of Atlantic-Richfield, one of its credit authorization customers. In so doing, NDC beat the banking community to the draw, which serves to illustrate the point that the market for payments services is not guaranteed to the banks. This is equally true in Canada.

In the computer services business, smaller companies now offering financial services such as payroll and accounts receivable will face heavy competition from the large financial institutions. In these generalized business applications, the small service bureaux will be hard-pressed to compete effectively. To survive, they will be forced to specialize in the particular applications of one or more industries.

Another effect will be the increase in skill and experience in Canada, which will result from the development of automated financial systems. This is even now being brought about by bank in-house training programs for hundreds of programmers and systems analysts. Research and development efforts by bank staffs and by contracted developers are, for the most part, taking place in Canada. The experience with large project management and real-time systems is transferable and will benefit the development of other on-line real-time systems in the future. The importance of this benefit should not be underestimated because of the huge potential for cost-savings in future systems-development. High-calibre and experienced systems analysts can often reduce system implementation time and effort.

There does not appear to be a major export potential for financial systems. However, some terminal and software developments for Canadian banking may be exportable by companies such as IBM and NCR. There may also be a market in the U.S. for some stand-alone banking computer services — *e.g.*, mortgage accounting and portfolio management. But, there are too many differences between Canadian and U.S. banking for a complete Canadian on-line system to meet American requirements. However, should Canada acquire a reputation for expertise in this area, there will be an export market for consultants.

In this connection, it is worth noting that National Cash Register plans to manufacture banking terminal equipment in Canada with federal government assistance.

While it is always difficult to predict social change, some trends are likely to emerge as a result of increased automation in payments and credit methods, if only because finances are such an integral and important part of everyday life.

One broad effect will be an increasing public awareness of the general importance of computers through more direct encounters with computer terminals in banks, offices and stores. In time, this will lead to acceptance of

the computer's role and its integration into the social fabric. But before this stage is reached, there are bound to be crises of confidence and widespread complaints regarding the whole area of personal privacy.

Changes in payment methods will entail changes in purchasing and payment habits of individuals. For example, due to the loss of "float", those individuals who now take advantage of time-delays in clearing cheques will probably have to pay for the privilege of delaying payment. However, to cushion the impact of this change, a standard delay might be a necessary part of an electronic system.

Due to reduction in free bank balances, banks will tend to collect more revenue from service-charges. Since these are more readily visible and understandable to the public, the average consumer will pay more attention to his banking costs, and advocates of consumer interests will attempt to bring pressure on the banks to keep charges down. There will also be the increased convenience of making deposits, obtaining loans without undergoing long personal interviews and not having to reconcile bank statements. There will be fewer trips to the bank. In actual purchasing, there could be the added convenience of not having to carry around large amounts of cash (less chance of loss or thef and of having a consolidated record of purchases provided by one's bank. As far as credit cards are concerned, the growth of multi-purpose bank-cards will mean a decrease in the number of cards an individual has to carry around in his wallet.

An electronic payments and credit system will have an effect on the operations of many government departments. Some of these effects have already been mentioned. The coverage in this section is by no means complete, but it does indicate the number of government departments and agencies that could be affected by an electronic payments and credit system.

Government responsibility for the monetary system has long been recognized. Since an electronic payments/credit system will have profound effects on the monetary system, government bodies must be prepared to modify their policies and their models to accommodate the changes as they evolve. Ultimately there will be a decrease in the supply of currency in circulation and in demand deposit levels, both significant components of the money supply. This will stem from a reduced need for currency and a greater velocity of money transfer. As a result, funds will shift into term deposits and long-term investments. This would seem to be a beneficial effect, but may necessitate a re-definition of the money supply and new ways of interpreting its significance.

Data on the performance of the economy will be available more quickly through computer-based systems that collect data at the point of transaction and are capable of rapidly integrating these data into a composite picture of what is happening. In conjunction with the data collection and analysis capabilities of computer-based financial systems, the speed of electronic transaction processing will reduce time-lags in the effect of changes in money

supply, and interest-rates. This means that the economy will be more responsive in a time sense to monetary and fiscal changes.

In its capacity as payor of federal government funds, the Department of Supply and Services will be able to make use of an electronic payments system to reduce costs. This Department is currently studying the feasibility of paying federal public servants by means of direct funds transfer. Current plans call for optional direct crediting of payroll by 1972 or 1973. In the future, this technique can be applied to a variety of government payments to individuals, such as pension, welfare, unemployment insurance and family benefits. Ultimately, it will also be extended to their accounts payable.

The Department of National Revenue (Taxation) already makes heavy use of computers and may someday form a component of a national electronic payments system for the collection of taxes without cash or cheques. This would certainly cut down on paperwork. Ultimately, taxes might be pre-calculated by computer and automatically deducted by banks for credit to the government. This approach would relieve employers of having to make income-tax deductions. If bank files contained a nationally-used individual identification, all necessary tax information could be forwarded electronically, eliminating the need for T4W, T5W forms and other documents, and also many redundant data preparation steps.

As business systems become more automated and linked through an on-line financial network, it is entirely feasible that many operating and financial statistics required by Statistics Canada could be acquired directly in electronic form. Again this has a great potential for paperwork reduction at both ends of the information flow.

The Post Office may be affected by a decrease in mail volume as the use of mail to send cheques, bills and statements declines. A study made by the Kappel Commission on postal services in the United States showed that 40% of all mail consisted of financial transactions. It is assumed that the same proportion holds true in Canada. The main development which may affect cheque-flow in the near future is pre-authorization. A recent Canadian Post Office study[1] predicts a 10% reduction in the volume of mail by 1985, as a result of the introduction of this system.

APPENDIX TO PART B1

APPENDIX 1

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Applications in Education

INTRODUCTION

The purpose of this study is to survey both the present state, and possible future impact, of computer/communications in the field of education in Canada. It does not attempt to either evaluate or recommend particular systems or methods either currently or potentially in use in this field.

Earlier studies and discussions with informed sources indicate that the main areas of computer application in the field of education are:

Administrative Systems
Computer-Aided Learning Systems
Information Retrieval Television
Systems (IRTV)

Examining the impact of technology on society today has been likened to assessing the impact of the automobile by judging reactions to the Model-T in the 1920's. One could say that computer applications in education have not even reached the Model-T stage. They are still in their infancy. They exist mainly as small, experimental systems and few people beyond those directly involved know of their existence or understand their potential. It is therefore difficult to obtain comments from anyone outside this group which, by virtue of its involvement, is both enthusiastic and optimistic.

No attempt has been made to derive a consensus via a large statistical survey. The Trans-Canada Telephone System has recently sponsored a study[1] on the future of educational technology using the Delphi technique. This study has been used for reference whenever aggregate opinion is necessary. Otherwise, all known experimental systems in Canada, falling within the frame of reference of this study, have been visited and informed opinion collected from individuals involved. These opinions, particularly when consistent, have been used in the preparation of the present study. Other statistical information has been obtained from Statistics Canada, the Economic Council of Canada and the Department of Manpower and Immigration.

The educational applications using computer/communications techniques characteristically have limited funds available for their development. Funding is being established by the Quebec Department of Education for the further expansion of computer-assisted applications in education. The Province of Ontario is presently developing administrative applications to be offered to its school boards. All other operational installations are funded either from private sources or school-board operating funds. At the post-secondary level, little co-operation exists between the institutions, beyond the sharing of ideas at conferences. However, at this level, with larger funds available and greater autonomy, a good deal of work has been done.

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[1] Doyle, F. J. & Goodwin, D. Z., *An exploration of the future in educational technology* (Bell Canada, 1971)

The major applications which have emerged in the administrative area are student-record systems, including university admissions, career-guidance and time-tabling systems. At the elementary and secondary school level, little has been achieved, while at the post-secondary level, many ''tailor-made'' systems have been developed. A potential market of $34 million for 1975 is based on 5% of the current administration budgets.

In the area of computer-aided learning (CAL), projects in Canada are mostly experimental, using very limited funds. The potential market for 1975 is estimated to be $118 million. These new learning systems will require a short-term injection of substantial funds if any significant development and penetration is to result. Considerable effort would be required to adjust the educational system, if the potential benefits of CAL are to be realized. Few people beyond those closely associated with the experimental projects are aware of what CAL means, or how to use it. Particularily with the current surplus of teachers, together with unemployment and the initial concern with which automation is regarded, CAL systems face a somewhat difficult immediate future.

IRTV Systems seem to have an independent future in the short-term, but a much more integrated role with CAL systems in the long-term. There is, at present, only one known pilot-system, and it has been well used by the participants. Because of the integration possibilities, it is difficult to estimate the market for IRTV as a separate system.

The present application and future potential of both CAL and IRTV systems is discussed in greater detail in Chapter I, Sections 2 and 3. Further aspects of CAL's usage are examined in Chapter II, Section 2.

Chapter I
Current Activity in Canada

1. ADMINISTRATION

All universities and most community colleges in Canada have varying degrees of computerization. These cover applications from payroll and financial accounting to course scheduling, student record-keeping and space inventories. The degree and extent of implementation of such systems vary widely. They are generally developed by the institution in question and initially are using facilities installed for research, development and teaching. As the applications have grown, so have separate administrative computer departments. Administrators generally prefer to remain inviolate from the compliations posed by sharing facilities with inquisitive and inventive students.

At the elementary and secondary school levels, some urban school-boards mainly in Quebec and Ontario are using simple administrative systems. School-board budgets tend to keep individual participation at a low level, but these two provinces are now developing administrative computer systems services, which they are offering to their school-boards from central facilities.

(a) Student Information Systems

Information systems on students have been computerized at many of the larger post-secondary institutions. These systems have evolved over a period of time by the institutions concerned and now require integration with financial systems and space inventory systems. This integration process is already taking place at a number of universities. In Quebec, through the CESIGU (Comité d'élaboration du systeme d'informatique de gestion universitaire) group, the development of a student information system is being co-ordinated. At the elementary and secondary levels in Quebec, a large number of school-boards have, or will have, access to the facilities of the Department of Education. Among the remaining provinces, some have availed themselves of the services offered by Statistics Canada.

Arising out of an initiative in 1968, by the Council of Ministers of Education, Statistics Canada was requested to develop an educational data base, and the administrative procedures which would accompany it, as far as available funds would permit. Initial Student Information Systems have been developed at Statistics Canada for the prairie provinces, who have now taken over the system, and administer it themselves. Some Atlantic provinces have been introduced to the system during the past year. British Columbia is now in process of adopting it.

The Peel County Board of Education has been exploring the possibility of using computer/communications facilities for administrative functions. A joint project between the Peel County Board of Education, and private industry, partially funded by the Canadian Computer/Communications Task Force was established to assess the feasibility of this approach. The pilot-project provides for 2 transaction-type terminals and 2 teletype terminals, one of each located in Kennedy High School and the other two in the Board's administrative office. The applications covered are payroll, student record-keeping, including

attendance records, staff record-keeping, and marking of multiple-choice questions. Both types of input devices will be assessed by the school and by the administrative office. It is hoped that this approach will give the staff ready access to information which was previously difficult to extract from the files, thereby increasing their effectiveness in dealing with potential problems at an early stage.

In co-operation with the Department of Education in Quebec, the universities, through CESIGU, are developing a group of programs to cover such administrative functions as financial information and space inventory, as well as student and staff information-systems. Once the specifications have been outlined and agreed to by the group, each university will undertake a portion of the work, which they will develop and implement as a pilot-system. When each section is functioning satisfactorily, other co-operating universities will start to use it, either in their own installations or via a network. It is expected that this project will have all sub-sections ready for full implementation by the end of 1975. The cost will be borne in part by the universities and in part by the Department of Education.

(b) Time-table Systems

At post-secondary levels, time-tables are computer-prepared at a number of institutions. These systems vary in sophistication from full-scale simulations to seat-reservation systems; and even within a given university, the techniques vary from faculty to faculty. Computerized time-tabling services are available from MIT and Purdue on their systems, but the costs are considerably higher than can normally be afforded by either the school-boards or most post-secondary institutions ($20,000-$50,000 per year). Two provinces are known to be taking action to provide their school-boards with a form of computerized time-tabling services; and experiments with the Stanford System are being conducted in Alberta.

The Ontario Department of Education is offering a service to its school-boards to assist in the development of school time-tables. This system accepts a sample time-table prepared by the school, compares it against a previously entered set of student course requests, then evaluates and lists conflicts (student, room and teacher) and unsatisfied requests, as well as preparing teacher schedules, pupil schedules and room schedules. This output is then returned to the school for further refinement of the time-table. At present, one third of the Ontario school-boards are using this system on an IBM 360/50, some via remote batch-entry and others via the mail. The number of users is currently limited by the number of advisors available in the Department of Education to assist in the use of the system.

The University of Laval has developed an elaborate and sophisticated system, allowing many parameters as input, and producing in a single pass a fully optimized time-table. Inputs comprise student course requests, teacher capability and requests, classrooms available, including capacity and fixed equipment, course requirements (previous course completion, equipment, etc.), and a rating for the difficulty of the course. These inputs may be constrained by such items as limiting the number of difficult courses taken by one student on a particular day, or requiring a certain time interval between difficult

courses. The resultant time-table is produced in a single run on an IBM 360/50. Cost figures of $8,000 for a time-table for Laval itself, comprising 10,000 students and 1,200 members of staff are being quoted. The development has been funded by the Quebec Department of Education and, after a full-scale test at Laval, it will be made available to all the school boards in Quebec.

(c) Career Guidance Systems

Career guidance systems have not been extensively developed in Canada. The systems-design phase for one of them is under way at the Department of Education in Ontario, and some work has been done in Alberta, by both the University of Calgary and the University of Alberta. At Calgary, sufficient work has been accomplished for the system to be considered operational, and courses for counsellors have now begun. These systems essentially provide an information retrieval service on career information, relieving the counsellor of the problem of having to obtain the necessary facts from a great number of sources. However, it is hoped in Calgary that this concept can be extended to actively help students make better career decisions.

2. COMPUTER-AIDED LEARNING SYSTEMS

As was mentioned in the Introduction, only a limited amount of experimentation with computer-aided learning (CAL) systems, has so far occurred in Canada. The testing that has taken place is already demonstrating the lack of inter-changeability which has characterized developments in the U.S. Even between the University of Alberta and Simon Fraser University, both of which use IBM's COURSEWRITER, exchange of course material is not easily achieved because of differences in machine configuration, operating system requirements, and different implementations of COURSEWRITER itself. Recognition of this problem has prompted NRC, through its Associate Committee on Instructional Technology, to prepare specifications for an authorship language, with the hope that it will be adopted as a standard for Canadian development of course material.

The NRC Information Sciences Division project, which was started in 1967, has acquired a PDP-10, as the basis for offering free computer time for development of CAL to various provincial organizations. Since there is increasing concern about incompatibilities in software, NRC (as mentioned above) is co-ordinating a national committee to specify an authorship language for CAL. The draft specifications of this language are being prepared now. NRC is also conducting some research into terminals suitable for educational use.

At the present time, participation in the project is limited. The greatest use is at the Ontario Institute for Studies in Education which is developing a remedial mathematics course. More remotely located participants are hampered by the present high cost of data communication services. However, arrangements have been established with the universities in the west and in Ontario and it is hoped to expand the number of participants during the coming year. For further details on the NRC project, see Appendix 2.

The Quebec Department of Education has been conducting a research and evaluation project into CAL, using an IBM 1500 series system. Even though the system is equipped with only a relatively small number of work stations, a carefully planned program of research is yielding encouraging results. The Department now feels that it has a good grasp of the scope and value of the medium, and will soon be ready to launch a second phase of development making more extensive use of it, as well as developing course material in appropriate areas.

The high degree of interest shown by members of the Department of Chemistry at Simon Fraser University has led to the development of CAL and its use in teaching, particularly at the first-year level. The course repertoire has been extended to permit experimental work with some schools in the area, and one or two more remotely located at Kelowna. (Plans for the future will include several community colleges.) Courses are prepared by the combined efforts of a lecturer and programmer who is familiar with the idiosyncrasies of the authorship language and with the techniques best suited to computer-assisted learning. The project is organized as a separate entity, under the budget of the Academic Vice-President, and run on an IBM 370/155 on a shared basis with other work. It is funded primarily from university funds, although grants have been made available by such organizations as B.C. Telephone Company, to cover specific experiments within the schools.

At the University of Alberta an IBM 1500 series educational system has been in operation for over two years. Considerable development in course material, particularly by the Medical Faculty, has resulted in this becoming one of the most advanced projects in Canada. In conjunction with the Medical Council, a project is being developed (based on experience gained with the Medical Faculty) to provide many level examinations in clinical competence, using such computer techniques as simulations. This particular project has initially been funded by the Medical Council, but application has been made to the Department of National Health and Welfare for further subsidy. The course material is usually developed by a combination of programmer and lecturer, although some lecturers have developed and designed their own complete courses. Financing for the extensive development of university and school course material, and initial provision of the system, has basically been from university funds, with some donations to the school experiments from the Alberta Human Resources Council.

The Computer Applications Division of the Ontario Institute of Studies in Education (OISE) has been experimenting with CAL for some time, using a PDP-9 acquired by a Department of Manpower grant. Considerable work has been done on language development, and the language currently used on the NRC project is the one developed by OISE. The University of Western Ontario also uses a derivative of the OISE language. Current projects under way are the production of a remedial mathematics course for entrants to manpower retraining programs, preparation of second language instruction and high-school physics. The evaluation phase for the remedial mathematics course has already been prepared, and this is now under test at two or three community colleges. The correctional phase is under development. Both phases are being implemented on the NRC PDP-10. The second language development project

is still in the design stage with a feasibility study being prepared. The high-school physics program is operational at two high-schools in North York on the PDP-9. OISE funds have been used for development of material, with outside funds now being sought for the second language instruction project.

The Computer Science Department at University of Western Ontario has been introducing different teaching methods for the computer science course over the past three years. This work has used both CAL and video tape. The video tapes have subsequently been released to be shown on cable television in Sarnia. The experiment is being repeated at a summer school in Owen Sound this summer. Within the university, CAL has been used primarily for first-year computer science and mathematics teaching, although some experiments have been conducted in local schools. The projects run on a shared basis on the university's PDP-10 and are primarily funded by the university.

Using a Digital Equipment Corp. TSS-8, the University of Calgary supports 16 terminals, of which 4 are located in a trailer, serving junior high schools. Some terminals are equipped with random-access slide projectors. Course material has been developed by academic staff and graduate students, with funding from the Alberta Human Resources Council, NRC and Canada Council, as well as the university.

3 INFORMATION RETRIEVAL TELEVISION SYSTEMS

Information Retrieval Television Systems are being examined as a means of resolving the difficulties presented to schools by the fixed schedule of Education Television on a single channel, and the problems involved in transporting film to the appropriate school in time for the class. Only one pilot-project has been implemented, with the concept being considered seriously in some metropolitan centres.

In conjunction with Bell Northern Research and OISE, the Ottawa Board of Education instituted a pilot-project to evaluate the use of IRTV. One hundred and fifty classrooms in five schools were outfitted with a twelve-channel cable outlet, a TV monitor and a telephone. Teachers telephoned in requests for particular films, to either a person or a computer, and these were shown on the first available channel, starting within 60 seconds, if so desired. The instantaneous access, while pleasant, was not found necessary, since most teachers plan classes at least a day ahead. But the availability of material at a time to suit the class resulted in the system being well used. The pilot stage is now complete, and the Ottawa Board of Education will extend the network to other schools over a period of time, but will reduce the number of telephone installations. Extra TV monitors will be added gradually, but existing monitors can be shared on a scheduled basis. The pilot-project costs were borne by the four participants: Bell Canada, who supplied the cable system and the projection equipment; Bell Northern Research, who provided the planning; OISE, who furnished programming support for the scheduling and performed an evaluation study; and the Ottawa Board of Education, which provided the monitors and the film library.

Chapter II
Computer/Communications Potential in Education

The rapid advances in technology in the last decade and research programs such as the PLATO project at the University of Illinois, have expanded the potential for computer applications in education and given early indications of a possible new form of education.

In the U.S., during the mid-sixties, a state of euphoria existed regarding the potential market in education and its rate of development. In 1968, it was forecast that sales in 1975 would be in excess of $100 million. However, in 1970 the forecast was reduced to less than $25 million, which indicates a far more cautious expectation today.

In Canada, while the potential for using such new techniques, particularly the computer/communications networks, is high, there are many factors inhibiting the growth of the instruction technology industry. In the Bell Canada Delphi "Study on the Future of Educational Technology", the total sample included U.S. as well as Canadian participants. The report repeatedly points out that the time-estimates for use between the U.S. portion of the sample and the Canadian portion differs in some instances by as much as 15 years.

1. ADMINISTRATION

For 1975, the operating budgets of the elementary and secondary schools in Canada are estimated to be $7.16 billion. In the past, an average of 6% of this amount has been devoted to administration, giving an administrative budget of $430 million for 1975. If 5% of the projected administrative figure is set aside for computer application, this will represent a potential market of $21.5 million.

On-line service capability is not paramount in most administrative applications, except possibly in the field of career guidance. However, the availability of on-line systems will tend to increase the effective use to which teachers put their administrative time. Though this has little direct bearing on the costs of education, it will tend to improve its efficiency.

In 1975, the post-secondary institutions are forecast to spend $4.15 billion, with an administrative budget of $249 million. Again, 5% of this budget would represent a $12.45 million computer communications market, giving a total potential market of approximately $34 million.

In the next ten years, the greatest potential for the computer in education is likely to be in administrative applications. The continuing awareness of the computer as a tool in this area makes use of the computer inevitable, particularly as costs of computing come down. Clearly, this market is open to the private sector of the economy, and some portion of it will be serviced by that sector, though competition from provincial cost recovery systems cannot be ignored. Moreover, if career guidance systems are developed, the economies of scale make centralization of these systems inevitable. Again, such services could be provided by the private sector. This, however, would result in a fairly long selling period before profits could be realized. The rate of development and use of systems will closely parallel the economic activity

of the province. School boards close to the provincial centre will be the first to avail themselves of such services, since their communication costs would be the lowest.

Apart from the direct budgetary expenditures on administration, there is also an indirect expenditure incurred by the amount of time teaching staff has to spend on administrative duties. One school-board, Peel County, estimates that the proportion of teacher time spent on administrative duties is as much as 20%. However, even with computerized administrative systems, it is not clear that this figure can be significantly reduced, since some form of supervised data gathering for attendance records will still be necessary, as well as some checks on attendance patterns. Computerized techniques generally permit a more comprehensive administrative function to be performed, giving staff easier access to the information they may require. The areas of multiple-choice test marking and time-table preparation have the greatest potential for saving time through the use of computerized techniques. Rapid development is likely to come in these areas since increased emphasis is being placed on a broader choice of subject matter at school, making time-table preparation an increasingly arduous task.

2. COMPUTER-AIDED LEARNING SYSTEMS

Computer-aided learning systems offer the greatest potential for savings, since teacher salaries form the largest portion of any educational institution's budget. CAL offers the possibility of increased efficiency in the education system, since there is already evidence[2] that, on the average, a student learns faster using CAL techniques. Teaching time, once freed by the introduction of CAL, could be used to meet other educational requirements. It could also provide these classes with all the educational benefits to be derived from CAL. In the initial stages, high cost areas of education, as in the medical field, could well be the proving grounds for CAL. The increasing emphasis on more individualized instruction also gives impetus to developments in this field. Informed opinion, such as that of Dr. Fred Whitworth of the Saskatchewan Education Research Center, indicates that 20% of the total current curriculum will lend itself to computer-aided, or computer-managed, learning, techniques. While it will probably not be feasible to reduce the teaching staff by an equivalent percentage, a reduction of 15% might be a reasonable assumption when the present number of pupils is taken into consideration.

At the elementary and secondary levels in 1975, the budgets are projected to be \$7.16 billion. 75% of this is \$5.37 billion. Thus, 15% of the salary budget in 1975 would be \$860 million. It has been estimated by Dr. Bitzer at the PLATO IV project in Illinois, that his system, serving 4,000 terminals at 50 cents per student hour, has an operating cost of \$4 million a year, based on current technology (see Appendix 3). If 20% of the course material requires computer-aided presentation, a ratio of 1 terminal to every 5 students is desirable. Thus, a system with operating costs of \$4 million a

[2] Hansen, D. N., "Current Research Development in Computer-Assisted Instruction", Tech Memo No 17, Project NR 154-280 sponsored by Personnel and Training Research Programs, Psychological Sciences Division, Office of Naval Research Washington, D.C. (Reproduced by the Clearinghouse for Federal Scientific & Technical Information, Springfield, Virginia), February 15, 1970

year will serve 20,000 students. It is estimated that the enrolled students in elementary and secondary schools will be 5.7 million in 1975, requiring 285 centres to serve all children. The cost, based on current figures, would therefore be $1.14 billion. However, if the costs are reduced to 35 cents per student hour (as Dr. Bitzer hopes) by 1975, the cost of providing this service will be $798 million. While this represents a limited saving at the elementary and secondary school level, it does suggest the possibility of providing "better" education at a slightly lower projected cost.

At the post-secondary level, the student population is forecast to be 850,000 in 1975, requiring 43 centres of the PLATO type to deliver 20% of course material at a cost of $172 million based on the current 50 cents per student hour, or $120 million at 35 cents per student hour. 60% of the expected salary budget is $2.49 billion and 15% of this is $374 million. Thus, even basing expectations on current costs, a saving may be expected at post-secondary levels.

The eventual potential market is 15% of the teaching budgets. However, it is unlikely that a 20% utilization figure would be achieved by 1975, and even more unlikely that the teaching force could be reduced by 15%. If 10% of this eventual figure seems reasonable as the potential market, then this represents $118 million dollars.

A centralized configuration appears to be the one receiving most attention, although the recent advent of the mini-computers may radically change the physical configuration, and network requirements. While none of the [illegible]ials questioned had given much thought to the use of mini-computers, except possibly as multiplexing devices, the general feeling was that this method would cause two difficulties. First, there would be the problem of distributing computer hardware maintenance and operation over a much wider area; and second, that the processing and memory capacity of mini-computers may be insufficient to compete with economies of scale which would be made possible by the larger computers of the next generation, particularly if the communications rates are adjusted.

Because of the need for control by education authorities over the content of courses, and the relatively high costs of development of CAL systems, it is unlikely that the private sector will develop them. Clearly, they will provide hardware and some system software, such as language processors, communications software, and so on. However, the amount of money required for CAL's full development makes the use of public funding inevitable.

The primary technical delay in the implementation of computer-aided learning systems in the next ten years will be the preparation of adequate course material. Overcoming this problem will require a sizeable injection of funds, which will not be recoverable for a considerable period of time. There is also an inherent difficulty in changing the structure of the educational institution, so that all forms of educational technology are treated as an integral part of

the teaching process, rather than as strictly incremental aids. This change of approach is essential to achieve the eventual cost-effectiveness of computer-aided learning systems.

The Bell Delphi "Study of the Future of Education" questioned a group of people knowledgeable in the field of CAL. The study asked the group to assess the time-span within which they expect CAL systems to have gained 20% utilization. They were also asked to assess the influence of cost on the rate of adoption of CAL, and, in the early sections of the study, society's rate of change of values. The study, however, does not directly address the problem of the rate of change of the current educational institutions. Within this framework of questions, a Canadian consensus emerged showing that CAL will be adopted at 20% utilization by 1978 in post-secondary institutions, and by 1983 in the primary institutions. Drill and practice systems will be the first to gain the widest use, rapidly followed by tutorial and simulation systems, then instructional game systems. However, the degree of complexity in programming socratic dialogue systems is such that it remains doubtful whether enough material of a sufficiently high standard will become available in the foreseeable future. A wide diversity of opinion existed in the study on the maximum acceptable costs of CAL, varying from \$1-\$10 per student hour, depending on the environment into which CAL is being introduced. The PLATO project, mentioned previously, has shown that much lower unit costs are possible.

Estimates provided by those involved in Canada in CAL work, consistently centre on 20% total utilization in the forseeable future. It can therefore be assumed that this could be taken to represent the potential market. The amount of work involved in preparing course materials (estimates vary from 25 — 150 hours for 1 hour of terminal time) is also very large, and the importance of producing high-calibre material cannot be overemphasized. It will require considerable, co-ordinated, dedicated effort at the post-secondary institutions to produce such a volume of material, establish hardware, and overcome some technical communications problems, if we are to have 20% utilization across the board by 1978, particularly with existing funding arrangements. It is also important to note that the number of people available in Canada with experience in the preparation of CAL courses at present does not number more than about fifty.

There is a further incentive for action to be taken in the area of post-secondary education, based on the rapidly rising costs in this sector of the education budget. Between 1961 and 1969 the costs of post-secondary education rose 5 times, while the enrollment increased by only 2.5 times. In the same period, the cost of elementary and secondary education rose 1.5 times with an enrollment increase of 0.25. As shown in Fig. 2, in 1961 it took 15% of the budget to educate 4.3% of the student population. In 1969, 20% of the budget was devoted to educating post-secondary students who formed 7% of the student population. In 1980, it is expected that it will require nearly 40% of the education budget to educate post-secondary students, who will represent less than 18% of the student population, if current trends continue.

Figure 1
Post-Secondary Enrollments and Costs as Percentages of Total: 1961-1980

Source: Statistics Canada

3. INFORMATION RETRIEVAL TELEVISION SYSTEMS

In the immediate future, the IRTV systems present a small market independent of the CAL market. In the long run, with the increase of computer-managed techniques, which will incorporate many aspects of educational technology, it is not clear that IRTV systems will survive on an independent basis. Professor Stephen Lower's words are representative of a growing body of opinion:

"Most important, we are beginning to see CAL as one component of an instructional system of which lectures, audiotapes, slides, etc. are other parts . . . . This might be considered a form of computer-managed instruction, in that the CAL system really paces the student through the material, albeit in an on-line fashion. It does seem to make more effective use of the various media, and most of our current new programming is taking advantage of this approach."[3]

The Bell Delphi study suggests that IRTV systems will be in use in all levels of education by 1985, at which time it is estimated that 55% utilization will have taken place. The study, however, does not examine the possibility of merging the IRTV functions with the computer-aided learning functions. Costs of $15 a year per student are quoted as acceptable, but it is not clear whether this is an incremental cost, or whether it partially replaces some existing expenditure.

[3] Lower, S. K., "CAI at Simon Fraser University", Department of Chemistry, Simon Fraser University, Burnaby, B.C. 1971

Chapter III
Computer-Aided Learning Systems

1. CONSIDERATIONS OF COSTS AND BENEFITS

As previously outlined in Chapter II, Section 2, the potential market for computer-aided learning systems is substantial. The PLATO project is the first large-scale attempt to prove the economic viability of this method. (See Appendix 3).

As shown in Chapter I, Section 2, it would be possible to consider a system such as the PLATO arrangement as representing some cost-savings in terms of the total education budget as early as 1975. This would, however, require high utilization, and an appropriate reduction in the staff salary budget.

In the PLATO project, the costs of the centre and the terminals are estimated on the basis that they will be used 8 hours a day, 250 days of the year and the equipment will be amortized over 5 years.

The costs of any computer-aided learning system may be broken down into four distinct components:

- Computer Hardware
- Terminals
- Communications
- Software

[illegible] four components all make contributions to the cost/student hour. The [illegible] communications, is at present the most difficult to estimate. Using [illegible] available facilities of the common carrier networks, and employing [illegible]nt rate structures, will clearly penalize those centres which attempt [illegible] provide service to a widely-distributed area, as opposed to those providing [illegible] densely populated area. In the PLATO project, this problem has [illegible]rcome by using an educational television channel to service 1,000 terminals. The cost of the cable service for this method is higher than the common carrier telephone service, but divided 1000 ways, the unit costs are significantly reduced, and, by simply dividing the total cost of the channel equally among 1,000 terminals, users pay the same amount, irrespective of distance.

The central processor costs tend to be small in comparison with all others. With the advent of systems with a higher computing capacity, where the cost per instruction is drastically reduced, this will become a declining factor.

The terminal costs are very much dependent on the degree of sophistication of the terminal. Terminal prices now being quoted to some of the Canadian centres vary from \$2,000 to \$10,000 purchase, depending on the features they offer. The PLATO project terminal costs a little under \$5,000 for a display unit, random-access slide selector unit and keyboard with one hardware and one software controlled character set.

Software costs are more difficult to determine. The ratio of preparation hours to usable hours varies widely, and appears to depend on the selected computer language for authorship as well as the experience of the author. However, one may assume that 100 hours of programming time are required

for each student hour, and that each student at elementary and secondary school has 8 hours of work, 250 days of the year and that 20% of this time (i.e. 400 terminal hours per student, per year) would be spent at a terminal. Then, if programming for all twelve grades is required, the work required is 400 x 12 x 100=480,000 hours, or 250 man years. Assuming an average salary of $15,000 per year for the production of these programs, this is a cost of $3.75 million for the personnel.

Operational costs for hardware availability for the development of this material will be in the order of $3 million a year. The full complement of terminals will not be required, although there would have to be enough terminals to serve the authors as needed, and about 5 years would be the minimum practical time to develop such material. This gives hardware costs of $15 million for the development period and a total cost of close to $19 million. In this instance, it would represent nationally less than 1 cent per student hour, amortized over 2 years.

Clearly this is a simplistic point of view. Development of equivalent courses in a second language is one problem Canada has to face. There is also a strong move towards offering a wide choice of subjects for study, particularly in the higher grades. It is also clear that not all schools study the same aspects of a given subject at the identical level, even within any one province, so that development costs are realistically going to be much higher.

To develop about twice the amount of material considered here, and to cover overheads, will require about $35 million spread over 5 years. There are also development costs for hardware and software support which will require funding to the level of about $50 million.

However, if each province develops its own course material on its own facilities, these simplistic development costs are multiplied 10 times for a national figure. Obviously, the provinces with a lower level of economic activity will not be able to afford them. Even in the more industrialized provinces, such a sum of money cannot be considered lightly.

If there is to be interprovincial co-operation, an authorship language should be adopted as a standard for course preparation, in order to make the portability of course material from one centre to another as easy and inexpensive as possible. The NRC work in this direction is a recognition of this problem, and with a timely decision, Canada may avoid the difficulties created by the incompatibilities in languages which have evolved in the United States.

Two cost-benefit studies have been conducted recently relating education to the GNP. One of these was prepared by NRC, as part of its justification for starting its CAL projects. The other was prepared by the National Council for Educational Technology of Great Britain.[4] In particular, the British study

[4] *Computer Based Learning Systems: Report of a feasibility study to outline an advanced program of research and development to apply computers to education and training* (National Council for Educational Technology, U.K., 1969)

emphasizes the difficulty of assessing whether introduction of different techniques in education produces a "better product". In the report's words: "in the field of education it is particularly difficult to specify this *better product*". The report continues:

"An exact calculation of the expected effect of CAL and CMI on 'National Benefit' or, to be more explicit, the quantification of the likely contribution which could be made to the GNP and towards 'Social Benefit', is, therefore, an insurmountable task at present; two cogent reasons, which in themselves are sufficient, are that:

- Estimates of potential educational efficiency of CAI/CMI will not be universally agreed unless more meaningful controlled experimentation gives a reliable measure of efficiency.
- the causal relationships, relating economic and social benefits to educational efficiency, are not yet understood."

Although the recent University of Illinois developments are promising, few of the previous attempts by manufacturers to produce an educational terminal [illegible] been successful. IBM, RCA and Westinghouse have made educational [illegible] efforts in the past. The IBM 1500 system supplies terminals that [illegible] CRT, light pen, keyboard, slide unit and audio unit. While these [illegible] very desirable, they are also costly both in hardware and [illegible] The software costs particularly, in terms of core requirements, limit [illegible] of the central system, and this in turn affects the cost-[illegible] of the system. Both IBM and RCA have curtailed their marketing effort in education in the immediate past, IBM closing their experiments with the 1500 series. In Canada, AGT Data Systems Ltd. has conducted some marketing in the educational field, which has also met with limited success. Until the advent of the contracts for the terminal at the University of Illinois and the developments at NRC, there has been little advertised development in specialized educational terminals in recent years.

The potential Canadian market is substantial. Previous sections have shown a potential market for 285 centres, supporting 4,000 terminals each, at the elementary and secondary levels alone. The efforts of the NRC Associate Committee on Instructional Technology to define specifications for an educational terminal have already established a focus of interest in Canada.

2. SOME SOCIAL AND PEDAGOGIC ASPECTS

The introduction of computer-aided learning systems in the school room is one of the most effective ways of developing an awareness of this new pervasive technology.

It has been suggested[5] that children with a low level of achievement will respond well to computer-aided learning. It has been proposed that if

[5] McLean L D Computer Technology in the Education of Migrant Children and other Disadvantaged Groups *AEDS Monitor* January 1968 p.8-14

computer-aided learning systems were used in penitentiaries they could provide enhanced educational opportunities to inmates.

Few controlled experiments have been conducted for a sufficent length of time to adequately measure the effects of CAL, but two examples indicate that the learning experience at least equals, if not surpasses, other methods, and usually in a shorter time. There has also been an increasing pressure in the late 1960's to provide more individualized instruction to the average, as well as to the weaker student, to prevent him from falling behind. CAL offers the potential of allowing each student to work at his own pace; of providing additional detailed instruction for the slower learners, as well as more advanced material, beyond the required scope of the course, for those learners who are ready for it. CAL, however, cannot entirely replace the social interaction of group instruction, since this interaction is an integral part of the human factor in education.

One of the controlled experiments conducted at the University of Illinois was in the teaching of nursing. Two groups of students of matching abilities were established, one taught by the traditional method, the other through the use of CAL. The course material was in maternity nursing and covered a subject range from anatomy and physiology to normal delivery. The two groups had one course in common: a clinical discussion. The PLATO students completed the course using, on the average, about 1/3 of the time required to present the same material in the classroom. There are also early indications that the PLATO students retained the material for a longer period of time.

The Stanford Research Institute has conducted extensive studies into educational applications, particularly with young children. Professor Oettinger of Harvard reports[6] that both he and Professor Suppes of Stanford observed the amazingly long periods of time which young children are able to spend at a terminal while covering wide areas of study. They have shown that the brightest children learn at rates that vary up to as much as ten times the rate of the slowest learner, demonstrating the problems faced by a teacher instructing a class of 30.

One of the advantages believed in the past to be contained in computer-aided learning techniques was the ability of the computer to accept free-form and unpredictable answers to questions and to cope with them. This appears to be far from the case and is best summed up by Professor Oettinger, when he states:

[6] Oettinger A. G. *Run, Computer, Run. The Mythology of Educational Innovation* (Harvard University Press, 1969) p 183

"Another advantage is seen in the computer's ability to handle responses constructed ad lib by the learner, rather than selected from pre-ordained alternatives. Some capability to recognize misspelled words and to pick out pre-selected key words does exist, but has not been used to the fullness of its limited advantages. Responses to requests like 'describe a relationship', 'define a concept', or 'explain how something works' are well beyond the realm of current computer capability. Recognizing arbitrary English sentences by computer is still beyond the frontier of either linguistic or computer science."[7]

On the same basis, computer-aided learning cannot readily take and use a child's own words to lead him on to the next subject or idea, nor can it adapt to the child's way of thinking, as can a teacher. It is clear that teachers will continue to play a vitally important role in the instruction of students. This role will shift in emphasis, allowing teachers more time to assist individual students. Yet another limitation of CAL is the problem of reliability. This is an area which has so far been given only passing thought. In experimental systems, reliability is not of paramount importance, but for an operational system it clearly is. A computer-aided learning system is composed of many components. In a centralized configuration, a single failure amongst a number [illegible] mponents can render the total system inoperable.

[illegible] IREMENTS FOR DEVELOPMENT

[illegible] are areas which must be considered and resolved before any [illegible] ful development and implementation of computer-aided learning [illegible] be achieved.

[illegible] on, those interviewed in Canada were concerned with the price of communication services. Most people felt that average input was short with some 5 to 20 characters on an average, and no one envisaged more than 60 characters being supplied as input. There is also a requirement for fast response. Again, maximum acceptable response-times varied from 1 to 4 seconds, and most of the people interviewed felt that younger students would not tolerate delayed long response-times as readily as older students. Frequently, even adults showed a tendency to thump at the keyboard delimiter button if nothing happened within a short time.

Current common carrier network facilities over a short distance will probably serve densely populated areas satisfactorily, at least for the development phase, but the bandwidth requirements of the terminal, the use of which comes in bursts, separated by relatively long "think periods", makes poor use of the available facilities. The facilities must be paid for, whether fully utilized or not, and this could make the communication costs for implementation the highest single factor in the total system cost. This heavily penalizes systems serving widely-scattered populations, increasing the possibility of regional disparity.

At present, extensive funds are not available in Canada for the development of computer-aided learning systems. Almost all the funds provided for the CAL projects are derived from university sources, with the exception of NRC Information Sciences Division. In the past, NRC granting policy has not permitted awarding of research grants for CAL, because it is not scientific research. Some of the universities have gone to other federal bodies such as the Canada Council, but these requests have met with little success.

While the technology involved in CAL has, to a certain extent, demonstrated its usefulness and applicability, it is doubtful that CAL could be implemented on a wide scale unless it is accompanied by changes in attitude towards this technique by many persons engaged in the educational process. An understanding of the aims and uses of CAL would be essential to school trustees and administrators, as well as the teaching profession.

The Department of Manpower and Immigration reported that, in the second quarter of 1971, it appears there will be a persistent teacher surplus during the '70's. In fact, the decline in the number of teachers required in the elementary schools has already started in the years 1971-72.

In the past, the introduction of audio-visual aids into the school system has usually been as an incremental cost. Teaching staff have been generally willing to use the new media, but only as a supplement to classroom presentation, rather than as an integral part of the teaching process. Educational television has also posed its problems. Arranging a class to watch something the teacher has not seen, at a time that is possibly inconvenient in the school time-table, has limited the use of ETV in schools. The incremental use of these media is not entirely the fault of the teacher. Apart from the scheduling difficulties experienced in the use of ETV, some of the material has been poor in quality and not geared to meet the particular requirements the individual teacher has decided upon for his course.

There will be a similar tendency to regard CAL as yet another incremental cost. Even more so if the material available is of doubtful quality. As has already been stressed, this medium is too expensive for such an approach to be practicable. Care would have to be exercised to ensure both the quality of the material developed and the training of the teachers in its proper use.

The costs of education in 1970 represented over 8% of the GNP, a higher proportion than in any other country. Costs have been rising at a rate in excess of the rise in the GNP. At the post-secondary levels, the portion of the GNP in 1961 was 0.72%; in 1969 it was 1.75%. An enrolment increase also took place in this period, and it is projected that post-secondary enrolment increases will continue until at least 1980. This could mean that Canada will devote 3.5% of the GNP in 1980 to post-secondary education, and this represents only 18% of the student population.

These rising cost figures give much incentive to an attempt to reduce the rate of increase. At the post-secondary level, it may well be justification for spending development money in the short-term. At the elementary and secondary levels, which more directly affect the rate-paying public, the short-term pressure to keep costs down may act as a deterrent to development of such systems.

4. USERS OF CAL

Two professional organizations, other than those directly concerned with education, are known to be actively interested in CAL, and to be pursuing studies in the area at present.

The high cost of examining the clinical competence of doctors, particularly specialists, has especially interested the Medical Council of Canada in developing computer simulation techniques to assist in this process. Examiners are usually practicing specialists, not teachers, who have contributed time to perform this function. The Medical Council has made an extensive study of this problem and presented to the Department of National Health and Welfare a request for funding to further this project.

The Society of Industrial Accountants of Canada organizes the training of industrial accountants. These activities comprise the preparation of curriculum content and course notes, and then contract with various post-secondary institutions to provide the courses. All are either evening or correspondence courses. Recently, a surprising rise in the percentage of students taking correspondence courses has taken place.

The Association is facing a shift of emphasis in activities which is away from the traditional accounting procedures. These are becoming increasingly computerized, and training is tending towards industrial accountants becoming interpreters and analysts of financial information. Recent changes have been defined for the curriculum and these are beginning to go into effect. However, some of the material does not lend itself at all to the correspondence course technique and only poorly to the traditional lecture technique. The Society is interested in computer-managed learning techniques, incorporating slides and video tape as part of the presentation, and is at present preparing a report on this subject for its membership.

APPENDICES TO PART B2

APPENDIX 1

INTERVIEW LIST

Institution	*Personnel*
National Research Council	Mr. W.C. Brown
	Mr. J.W. Brahan
University of Toronto	Mr. V.H. Mikkelsen
Ontario Institute for Studies in Education	Dr. L. McLean
	Dr. R. McLean
	Dr. S. Churchill
University of Western Ontario	Mr. P. Suttie
	Mrs. R. Newkirk
University of Alberta	Dr. S. Hunka
University of Calgary	Mrs. A. Brebner
Simon Fraser University	Dr. S. Lower
	Mr. N. Stroppa
Society of Industrial Accountants of Canada	Mr. N. Allan
Secretary of State's Office	Dr. D.C. Munroe
Statistics Canada	Dr. M. Wisenthal
Science Council of Canada	Mr. G. Miedzinski
Alberta Department of Education	Mr. R. Morton
Ontario Department of Education	Mr. B. Webber
	Mr. R. Wigdor
	Mr. B. Cook
University of Illinois	Dr. D. Bitzer
	Dr. B. Sherman
Quebec Department of Education	Mr. M.B. Croteau
Canadian School Trustees' Association	Mr. C.H. Witney
	Dr. F.E. Whitworth

APPENDIX 2

NRC COMPUTER-AIDED LEARNING PROJECT

Over the past five years, NRC has been evolving a research and development program in computer-aided learning systems. Undertaken by the Information Sciences Division of NRC, the project currently consists of a Digital Equipment Corporation PDP-10, providing centralized development facilities to all participants. The purpose in establishing this project was to avoid the enormous costs involved in fragmented development, by co-ordinating development across the country. The nationally distributed participants contribute to the project in two ways: The first is through membership on the Associate Committee on Instructional Technology. This committee provides a forum for co-ordination of projects, development of standardized technology and exchange of ideas. The second method of contribution is direct participation in development of either the technology or course content. Currently, the largest user of the PDP-10 facility is the Ontario Institute for Studies in Education.

The major thrust of the work underway on the PDP-10 at the present time is the development of a standard authorship language. The specifications for this language have been prepared and approved by the Associate Committee. When all the details are complete, NRC will undertake the preparation of [illegible]able compilers, either directly or through contract. Parallel with this development, work is also being done on the definition of an educational [illegible]minal. NRC has conducted some research into suitable input and output [illegible] for the education media, and in conjunction with Dr. Hallworth at the [illegible]sity of Calgary, is carrying out an evaluation program of prototype [illegible]

[illegible]elopment of course material is being undertaken right across the country. Courses developed on the PDP-10 facilities are made available at no charge, but the communication costs must at the present time be borne by the participants. This places a large financial burden on remotely-located participants, severely limiting the extent of their involvement.

APPENDIX 3

PLATO PROJECT

Under the direction of Dr. Donald Bitzer, the Computer Based Education Research Program at the University of Illinois has been underway for about ten years. Starting with feasibility projects in the early sixties to demonstrate the potential role of the computer in education, the project has now grown to the stage where it may be possible to demonstrate economic viability. A Control Data 6400, with extended core memory, was installed in 1970. Four TV channels are attached to this machine, and are allocated to the use of educational television. Using interfacing and multiplexing techniques developed by the University staff, each channel is capable of servicing 1,000 terminals. The terminals are a product of the University, combining a plasma display panel with a keyboard and a random-access slide selector. The terminals are connected to their channel via a controller capable of servicing 32 terminals. Again, the controller was developed by the university.

Parallel with the development of the hardware, there has been development of both support software and course material. Currently available are about 1,000 hours of material, covering a wide range of subjects and educational levels. The emphasis on parallel development of support software hardware and course material has enabled the systems-designers to obtain rapid evaluation of these developments and their applicability.

The costs for the current system are based on a 250 day year, with 8 hours use per day. On this basis, the 4,000 terminal configuration, with an average of 20 people accessing the same course at the same time, the costs are estimated to be 50 cents per student hour with terminal response time less than two seconds.

The costs are broken down as follows:

• Central Processing	10 cents	• Communications	4 cents
• Terminals	33 cents	• Software (course material)	3 cents

The costing for the central processing includes the operation of the CDC 6400, provision of support software, and amortization of the equipment. The advent of computers with higher computing capacity, leading to a reduced cost per instruction, indicates that the central processing costs will be a declining factor.

The terminal costs are based on a delivery of 500, built to the Illinois design under contract. With increased competition in this field, it is anticipated that the cost per terminal, particularly in a more basic form, will decline.

Communication costs are based on the service being available in such communities as Springfield, Champaign-Urbana and Chicago, and that they are available at ETV rates. The costs are then divided by 1,000 per channel to equalize them regardless of location.

The course content costs are difficult to determine, since they are dependent to some extent on the ratio of preparation to terminal hours. The cost for 2,700 hours of course material, amortized over 2 years, prepared at an average salary of $15,000 per year, is 3 cents per student hour. This implies the use of the material developed on one system only. Clearly if the material is applicable on more than one machine, either the course costs can be reduced or more material can be prepared at an equivalent cost per student.

Computers, Communications
and Canada's Health Care
Delivery System

INTRODUCTION

Under the terms of the British North America Act the provinces have the prime responsibility for providing health care to Canadians. At the federal level, the Department of National Health and Welfare is the agency which co-ordinates and directs all federal involvement in the field. Nevertheless, communications has an important role to play in any area where health services can be improved through computer power, because its effectiveness and efficiency can often be improved through the marriage of large, general-purpose computers and communication networks.

Hospital administrators or physicians may not *per se* be interested in the breadth and depth of automation. What does concern them, however, is the extent to which they can effectively use automation to improve patient care and keep down operating costs. The same principle applies, on a broader scale, at the regional, provincial and national levels. It is only where this can clearly be proved that a case can be made for automation.

The purposes of this report, therefore are to outline some of the possible benefits to be derived from applying computers and computer/communications to problems facing the health care field with respect to patient care and rising costs; to survey the extent to which this potential is being realized today: and to indicate the possible future patterns of growth of automation in this particular field.

Since the largest concentration of medical service is in hospitals, they are given particular emphasis. Indeed, virtually all health care computing is associated with hospitals at the present time.

This is not to say that in the areas of medical research and education, there is less valuable activity or less potential for computer use. The importance of this activity is not underrated, but in terms of usage of computers and communication technology, the effect is not as large as it could eventually become in the actual practice of medicine.

In the preparation of this study, the method of approach was first to request all provincial hospital associations and commissions for information with respect to member hospitals using computers. Following this, visits were made to over fifty Canadian health care delivery centres across the country. These included federal and provincial departments of health, hospitals, universities and institutes. They are listed in Appendix 1. Reference material and special papers used in this study are listed in Appendix 2. Acknowledgments are given in Appendix 3. Appendix 4 is a description of the Université de Sherbrooke Hospital Network.

Chapter I
Background

The health care delivery system in Canada has as its goal the provision of the best possible health care to the greatest number of people. The provision of these services involves many different medical and support functions. Chief among them are general hospitals, clinics and group practices, private practitioners, psychiatric hospitals, nursing homes, ambulance services and clinical laboratories. One could also include many of the manufacturers and service companies that cater to the health sector, but these are considered to be only indirectly connected with health care.

The British North America Act assigns the primary responsibility for the health of the population to the provinces. This responsibility is usually vested in a provincial Department of Public Health. Physicians are self-regulated through the College of Physicians and Surgeons, and through medical associations.

In recent years, governments in Canada have moved toward a guarantee of the right to health care, regardless of age, race, social status or place of residence. This has meant that health care services are being provided publicly, supported by mandatory insurance and tax systems. Provincial health programs now cover approximately 99% of the Canadian population. Under current legislation, the federal government pays approximately one-half the cost of necessary care for patients registered with a qualifying provincial health program. The remainder is funded by the provinces, from a combination of insurance premiums, sales tax and general revenue. Although provincial insuring commissions only exert budgetary control, the increasing governmental financial interest is leading to greater overall control.

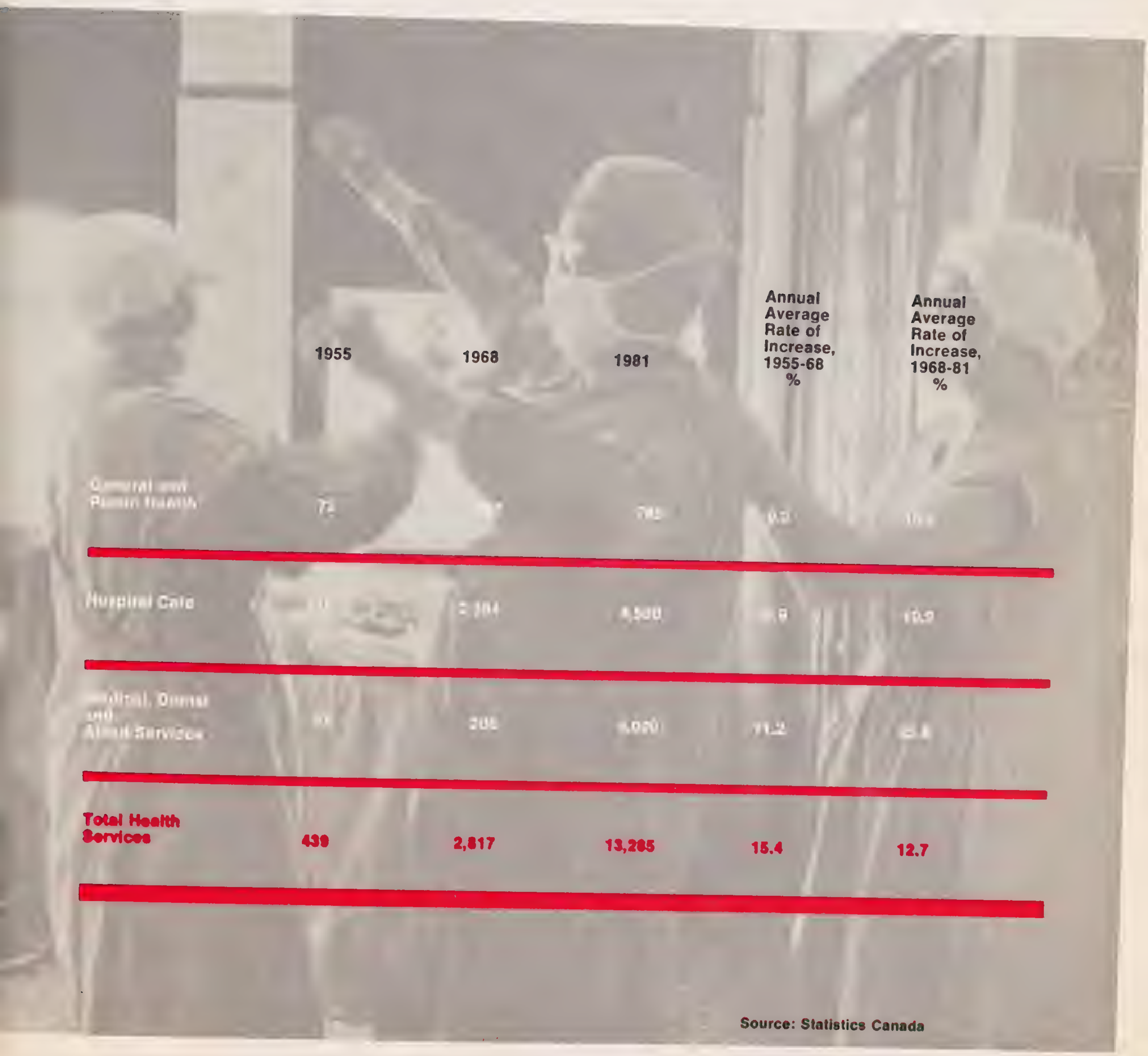
Even though the increase in overall life-expectancy during the past 45 years has been marginal, there has been a significant reduction from one death in five, in the first years of life in the 19th century, to one in fifty today. Thus more people reach maturity with a resultant increase in middle- and old-age hospitalizations. As the average age of the population increases, there are longer average recuperation periods, and a correspondingly bigger claim on hospital services. This trend is expected to continue to grow.

Increases in the demands on and costs of medical care and hospitals, precipitated by social measures, such as universal health insurance, has further heightened the demand for health care, leading to increased claims for hospital admissions to Canadian public hospitals. This average annual increase of 3.0% is well in excess of the normal population growth rate of 1.8%.

Yet another contributing factor is the increasing public expectation of more and better health services, which manifests itself in a demand for readily-available medical service, 24 hours a day.

This ever-expanding demand presents a problem because of the growing inability to satisfy public needs without sacrificing the quality of care rendered. One of the main reasons is cost. By 1968, health care was already consuming over 4% of the GNP and constituted the second-largest service industry. In 1955, by contrast, health services accounted for less than 2% of the GNP. By 1981, the figure is expected to rise to over $13 billion. These figures are summarized in Tables 1 and 2.

able 1
stimates and Projections for Health Services
955, 1968 and 1981 in Millions of Dollars ·



	1955	1968	1981	Annual Average Rate of Increase, 1955-68 %	Annual Average Rate of Increase, 1968-81 %
General and Public Health	[illegible]	[illegible]	785	[illegible]	[illegible]
Hospital Care	[illegible]	2,304	4,500	[illegible]	10.9
Medical, Dental and Allied Services	[illegible]	205	4,020	11.2	[illegible]
Total Health Services	**439**	**2,817**	**13,285**	**15.4**	**12.7**

Source: Statistics Canada

Table 2
Percentage Relationships
for Health Services: 1955, 1968 and 1981

	1955	1968	1981
Total Health Services	[illegible]	4.19	7.60
Total Health Services	[illegible]	12.1	18.9

Source: Statistics Canada

Hospitals will spend a major share of these large amounts. Between 1960 and 1969, hospital expenditures in Canada averaged an annual growth of 14.5% based on the figures in Table 3. In 1980, hospital costs are expected to rise to almost 8.5 billion (Table 1)

A further major trend is the increasing complexity of diagnosis and treatment. More and more, medical science finds itself forced to draw on an ever-developing number of disciplines — such as biology, chemistry, behavioural sciences and biomedical engineering. For practicing doctors, there is an increasing consciousness of the growing limitations of their knowledge because of their inability to keep up with newly-generated techniques and information. One of the consequences of the ever-changing complexity of medical science is the increase in medical specialization, leading to considerable changes in the traditional doctor-patient relationships.

With continuing increased specialization, highly-skilled practitioners in specific areas will tend to become less available in all localities. The same applies to the high-cost equipment (*e.g.*, radiology) which may be required for proper treatment. Such scarce and expensive resources must be fully utilized. Accordingly, this trend is forcing a new approach as to how health care resources should be distributed throughout a given area to provide adequate service at reasonable cost.

1. PROBLEMS, NEEDS AND OPPORTUNITIES

It should be pointed out that this report concentrates on weaknesses rather than strengths, in order to fit the technology into the picture. It is first necessary to establish the potential for computers and communications in this industry by demonstrating that it can have a valuable role. But one has to define the needs of a health system before one can say where computers and communications can help. It should also be noted that the phenomenon of rising health costs is not unique to Canada. It is being experienced in all highly-developed countries. At root, many of the technical problems at the operational level are the same, although Canadian solutions are uniquely tempered by considerations of geography, legislation and the variation in levels of prosperity between provinces.

Indeed, the effective geographical distribution of health care facilities is one of the main difficulties. The broad rule of thumb would be that costly, capital-intensive facilities should be centralized, and made available for use by all outlying agencies. Less expensive facilities can be spread more widely across the country, thus making them available to the individual patient. In practice, operations research studies and computer simulation models can be used to plan the location and physical design of future facilities. These methods can be based on such aspects as minimizing travel time and optimizing space allocation.

Another problem is the lack of an effective set of performance measures for the overall health care delivery system. As more source data are captured in

Table 3
Expenditures of Reporting General, Allied Special Hospitals:1960-1969

	1960		1969	
	Number of Hospitals	Expenditures	Number of Hospitals	Expenditures
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	242	720,605,142
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alberta	110	47,002,307	[illegible]	[illegible]
British Columbia	[illegible]	[illegible]	[illegible]	[illegible]
Yukon				[illegible]
[illegible]			[illegible]	[illegible]
Canada	**865**	**$592,842,153**	**997**	**$1,961,024,873**

Source: National Health & Welfare

machine-readable form from operating applications (*e.g.*, patient admission), a larger base of data will accumulate. In order to utilize this data base effectively for performance measures, it will be necessary to formulate an adequate conceptual framework and to develop valid models. Performance measures are needed, to enable a better control of the areas of manpower, services, costs and facilities.

The pronounced tendency toward specialization within the medical profession has made it more difficult for the average citizen to find a doctor familiar with the total family environment. This trend, combined with increasing personal mobility, means that few people can count on establishing a long-term, patient-doctor relationship. Today's health care is more fragmented and likely to involve a variety of consultations with several specialists. Thus, new methods and approaches are required to ensure continuity.

Certainly the computer, combined with modern communications techniques, can never supplant the personal and subtle doctor-patient relationship. However, in view of the inexorable trend toward still narrower specialization and the attendant fragmentation of service, these technological aids can serve as an integrating device, providing the necessary link between doctors, hospital, clinical staff and patient data which will help to ensure consistency of treatment. One means of achieving this could be the computerized patient history, which would be standardized to the extent that it could be used by all qualified medical personnel who attend a given patient.

Communications technology can also be used to advantage in another area — the dissemination of new knowledge and techniques. The time-lag between scientific discovery and its application in the health care industry will continue to increase unless new methods are adopted for bringing significant discoveries to the attention of busy physicians.

An application of this approach has already been experimented with in the U.S. It involves the use of new communication techniques (closed circuit TV, CRT displays etc.), to enable local doctors to consult on a long-distance basis with the most expert physicians available.

Another opportunity to reduce overall health costs, and improve the general health of the population, involves the greater use of preventive services. Here the contribution of the computer stems from its record-keeping capability. Any effective plan for preventive medicine demands accurate and timely records of patient characteristics, previous diagnosis and treatment. This would apply, for example, to vaccination and inoculation programs. Epidemiological studies, requiring large quantities of data, benefit greatly from the power and speed of the computer for data manipulation, retrieval and statistical calculations.

Finally, new computer-assisted techniques, such as multi-phasic screening, may have significant potential for reducing overall health care costs by "screening" out patients whose cases are relatively routine from those who require more detailed or complex specialist attention.

In general, computers can help the Health Services industry in a number of ways. The following are some of the methods:

- Lowering costs of an already-established service by reducing manpower requirements (*e.g.*, automated analysis, mechanized record-keeping);
- making available scarce, specialized medical capabilities throughout wider areas by means of communication technology (*e.g.*, remote ECG interpretation);
- providing more complex, integrated medical records for individuals and rapid access to crucial medical information (*e.g.*, poison-control data bank);
- providing better management-aids, through data collection and analysis, reporting and simulation techniques. This would assist in better planning of medical facilities and improved operating decisions as well as better ongoing utilization of facilities by the use of programmed aids to decision-making (*e.g.*, scheduling);
- improving the quality of existing services (*e.g.*, computer-assisted diagnosis, physiological monitoring);
- making it possible for new services to be implemented, or for available services to be performed by medical personnel with less training, thus reducing the load on physicians;
- combining hitherto separate services to improve efficiency;
- allowing for research involving large quantities of data;
- education and training of medical and para-medical staff.

HOSPITAL COMPUTER APPLICATIONS

[illegible] was mentioned earlier, hospitals are the present centre of health care in [illegible]ada. They account for approximately 84% of total health care costs. Thus, [illegible] intensive role and their correspondingly high volume of patients, make [illegible] the natural focus of any integrated plan for automation.

[illegible] and charges have been growing at a rate of 10 to 15% yearly, [illegible] of the 3.8% average growth rate for the Health and Personal [illegible]nent of the Cost of Living Index. As of the end of 1971, the [illegible] patient-day was reported by Statistics Canada at $65. By far the greatest sin[illegible] component of hospital operating costs is the cost of salaries and wages — amounting to 71.1% in 1971. These costs can be expected to continue to rise.

Most estimates place the cost of handling medical data at 25-30% of total hospital operating costs. Since computers can be efficient information processors, there is clearly an opportunity to reduce costs in this area. To the extent that routine data handling chores can be lifted from the shoulders of scarce, highly-trained professionals, their could be more effectively used in patient care and contact.

Within the category of administrative applications are the accounting and reporting sub-systems common to most businesses. Included are:

- Accounts Receivable
- Accounts Payable
- Payroll
- Billing General Ledger
- Capital Inventory
- Stores Control
- Budgeting.

The main benefits from automating these activities would stem from cost-reduction in preparing the hospital's basic accounting records. Side benefits would also be obtained in the form of more and better reports from the same data, increased speed of reporting, better management control and sometimes a savings on billings that tend to get lost in manual systems. Several reports on medical statistics, and for government reporting, can also be extracted from the accounting data. This latter area is of particular significance, as there has been an increased volume of statistical reporting for federal insuring and provincial government agencies, accreditation bodies, etc.

The applications in the category of patient care are directly related to medical, and medical support services. Some are hospital-wide in application, while others are sub-systems for the use of service centres within the hospital. Among the possible applications are:

- Automation of Food Services — dietary.
- Pharmacy — inventory control, purchasing, narcotics reports, etc.
- Radiology — scheduling and control.
- Clinical laboratories — calculations, and reporting.
- Staff/Patient Scheduling — *e.g.*, for out-patient clinics, operating rooms.
- Patient Records — including basic information, medical history, doctors' and nurses' notes, test results.
- Computer-assisted diagnosis.

Benefits to be obtained by using computers in these functions are harder to measure than in administrative activities. Partial savings can be expected in hospital space requirements, and in doctors', nurses' and laboratory technicians' time through computer scheduling. Such applications appear to have more immediate potential for reducing costs than any other single area. Scheduling of hospital in-patients, a complex job, lends itself admirably to computer assistance. Not only does it have to account for the order and rate of many different medical procedures, but it cannot be done deterministically, because each patient changes his characteristics over a given period of time. As another benefit, improved scheduling can reduce patient waiting-times and shorten average length of hospital stay. Centralized, automated patient records can mean increased time-saving by eliminating the re-recording of basic patient data, thus resulting in speedier, more accurate information. Furthermore, it could eliminate the duplication of costly laboratory tests for permanent readings (*e.g.*, blood type).

There are special applications of computers in hospitals which are extensions of the patient care applications, but are more-or-less "closed-loop" sub-systems and, as such, may best be performed using dedicated equipment. Examples are patient monitoring and automatic control of clinical laboratory equipment. Most benefits are not derived from direct cost savings, but through faster, more accurate patient care. While not cost-effective in the short-range, it may eventually prove that the increased speed and accuracy of patient treatment will help reduce the average length of stay and cut down on repeat visits.

From the total hospital viewpoint, it is desirable to bring together all data on a patient which have been generated in the various service centres. This, plus the need to manipulate these data, require the facilities of a large computer. On the other hand, within a given service centre (for example, a clinical lab),

the need for real-time control and data acquisition will probably always require a satellite mini-computer. This will be especially true in the foreseeable future, since the software for mini-lab applications has already been developed and field-tested over a period of years.

3. HEALTH CARE OUTSIDE HOSPITALS

There appears to be a trend toward more community centres and group practice, as opposed to single practitioners. If this trend continues, the group practitioners may be in a better position to make use of computer/communications technology, because of their higher volume of patients and large administrative workload. Just as in a hospital, computer services could be used to perform accounting and billing functions, assist in keeping patient records, scheduling patients and, perhaps, even assist in diagnosis through ECG analysis.

A further computer application could be related to the identification of medically fit patients who are abusing the system, or physicians who are needlessly over-utilizing resources.

An example of the above is shown by the recent findings of the Ontario [illegible] Services Insurance Plan (OHSIP) *e.g.*, the utilization rate — the number [illegible] a person receives annually — jumped 6% in 1971, compared to [illegible]d rise of 2%. This came to the attention of OHSIP executives as a [illegible]mputer statistics compiled from bills it received.

[illegible]mes and extended-care centres do not, as a rule, deal with the [illegible]nd complexity of treatment as does a hospital designed to [illegible] cases. Therefore, especially in terms of patient care, there is not [illegible]pe for computer application that exists in a general hospital. Still, as the cost of using computer-services declines, it is expected that administrative functions in medium and large-size nursing homes can be automated with a net reduction in costs.

Although organizations administering medical insurance plans are not directly involved in delivering health care, they are essential to the smooth operation of the health care system. They also account for significant costs, most of which are of a clerical or of a fixed-cost nature.

Since most of the payments to hospitals and physicians are made through the health insurance plans, the administrators of such plans are in a position to insist upon certain standards of performance, documentation of services performed, and adherence to established fee structures. This can have wide and important implications in relation to the development and use of those computer systems concerned with the accumulation of patient records or the preparation of statistical reports.

Chapter II
The Present Situation

Mechanized data processing was first used in a Canadian hospital in the early 1950's, when the Royal Victoria Hospital in Montreal installed punch-card unit record equipment. Even so, by 1960, the computer was little known in the Canadian health community. Progress in automation since then has been sporadic, varying from region to region. The widest and most cost-effective usage, both at the hospital and at the provincial health plan level, has been in business or administrative applications. The use of computers for billing and accounting is now beginning to penetrate both the group practice and the individual practitioner's office.

In terms of patient care applications, progress has been slower. There is currently no system developed, and operating, which meets all the needs of a "general" hospital information system. A number of independent, special-purpose systems have been successfully implemented, but the goal of a large-scale system, which has the potential for significantly increasing efficiency and reducing costs, has so far remained elusive. The major medical centres, usually associated with universities, tend to be the most advanced in developing and using new techniques for patient care. Some examples of [illegible]se projects are discussed later in this chapter.

[illegible] indication of the extent of computer usage in hospitals, Table 4 shows [illegible]r of hospitals using computers and the associated application areas [illegible] province. The emphasis on administrative applications is apparent [illegible]nd Inventory). At first glance, there appears to be significant use of [illegible]s for patient records, but the great majority of these are restricted to [illegible] the medical audit services and are of limited value in daily hospital [illegible]

[illegible] expended by Canadian hospitals on EDP services amounts to [illegible] the total cost of health care. By contrast, labour costs are [illegible] hospitals which have their own in-house general-[illegible]osts are approximately 4% of overall operating [illegible]

In absolute numbers, this amounted to about $7.4 million in 1971, according to Statistics Canada. This figure includes budgeted amounts for equipment rentals and purchases, depreciation and supplies, for in-house and contracted computer facilities plus unit record installations. These figures are summarized in Table 5.

Technically, the state of the art appears to have reached the point where it is now possible to automate a wide range of hospital and clinical services, both administrative and clinical. As we have seen, the present usage of computers indicates a gap between technical availability and practice. Some of the problems causing this gap are covered in Chapter III.

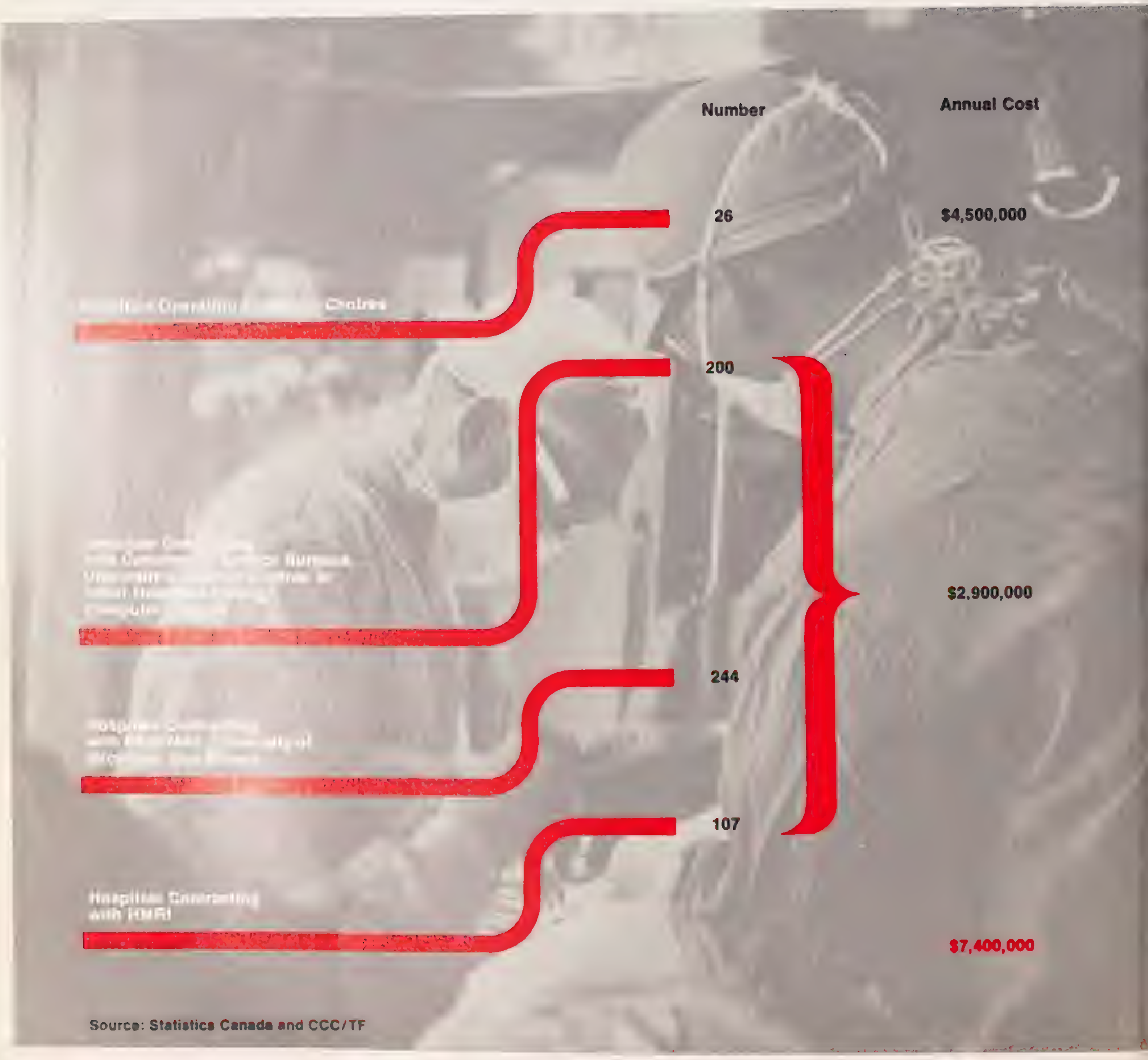
Table 4
Computerization in Canadian General Hospitals by Province: 1970*

Province	No. of General Hospitals	No. of Hospitals using Computers	Application: Payroll	Application: Medical Records	Application: Inventory	Application: Other**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	**911**	**340**	**340**	**196**	**82**	**3**

* Includes both In-House Computers and Contracts with Outside Organizations
** Includes pharmaceutical distribution; ECG interpretation; multiphasic screening; medical information retrieval; operating room management

Source: Statistics Canada

Table 5
Total EDP Expenditures
by Canadian Hospitals: 1971



	Number	Annual Cost
[illegible]	26	$4,500,000
[illegible]	200	$2,900,000
[illegible]	244	
Hospitals Contracting with HMRI	107	
		$7,400,000

Source: Statistics Canada and CCC/TF

1. ADMINISTRATIVE APPLICATIONS

Of all computer services relevant to the health care field, those of a clerical, book-keeping or administrative nature are the most general or non-unique in their requirements. So it is not surprising that administrative applications are the most widely automated and effectively used. The situation parallels the introduction of computers into industrial firms, where the initial emphasis lay in the mechanization of repetitive, clerical tasks, possessing reasonably well-defined methods and procedures.

The degree of efficiency of administrative functions is primarily a function of volume. More specifically, the volume must be high enough to lower the unit costs of processing to the point where costs plus the initial investment can be recovered. Because of their largely non-unique nature, administrative applications can be shared. Therefore, the service bureau approach has some attraction for smaller hospitals, in that it can serve to reduce unit costs by increasing the volume base. A commonly-used figure for the minimum size a hospital should be to justify its own computer for administrative functions is in the range of 400 to 500 beds.

Since batch-processing is adequate for the requirements of most administrative data processing, the "shared" or service bureau solution satisfactorily meets present-day needs.

In Canada, it is estimated that a full complement of administrative computer services entails costs of about $1.00 to $1.50 per patient-day. For the most part, hospital business applications are run on medium-sized, general-purpose computers. A Canadian hospital can obtain data processing by one of three arrangements:

- *By using an in-house, general-purpose computer.* This option is normally available only to relatively large hospitals, usually associated with a university.
- *Voluntary grouping of area hospitals to share the use of a general-purpose computer* This is the way most hospitals in Canada obtain EDP services. Since these services are provided on a batch-processing basis, with physical pick-up and delivery of input and output, shared services have naturally grown within certain geographic regions. In British Columbia and Manitoba, for example, several hospitals use the computer operated by their provincial hospital associations. Alberta is planning this kind of arrangement, with its Alberta Regional computer committee just starting up. In Saskatchewan, 8 hospitals have co-operated through the Hospital Systems Study Group to provide a common service for Accounts Receivable, Accounts Payable, Payroll, Inventory and Medical Records. It is planned to extend the service to 144 hospitals. In Ontario, three groups of hospitals have organized the sharing of computer systems for some administrative applications. The IBM 360/40, of the Sick Children's Hospital, Toronto is now used for data processing by several Toronto hospitals. It is planned to move the computer to a separate location. In the Hamilton area, 8 hospitals and medical centres share the use of an IBM 360/25. Twenty-four hospitals in south-western Ontario have set up a shared computer facility in London, and have ordered a B2500 computer. Twelve Niagara Peninsula hospitals are attempting a similar type of arrangement. In the Montreal area, two groups of hospitals, English and French, each share a computer facility at the Royal Victoria Hospital and Notre Dame Hospital, respectively. There is a similar computer-sharing for administrative work in the Chicoutimi sub-region and in the Sherbrooke region.

- *Buying the services of a commercial service bureau.* The use of commercial services by hospitals is not widespread, about 35 Ontario hospitals, and about 15 hospitals in the Maritimes, use data centres for their payroll. The Ottawa Civic Hospital is a special case, in that it contracts all its administrative data processing (except laboratory reporting), to a local service bureau.

2. PATIENT CARE APPLICATIONS

Implementation of patient care applications has proceeded cautiously for two main reasons. First, since these applications directly affect a patient's health, medical staff must be totally convinced of their accuracy and reliability. Second, motivation has been slight, because up until now they have not been found to be cost-effective, although it is acknowledged that they can improve patient care.

Central to the system is the patient record. In the past, the data in these records did not have the range of precision needed for modern clinical decisions. As far as input and conversion are concerned, there is difficulty in establishing a suitable format. Much of the data needed is available today only [illegible] written form, and requires conversion to digital coding before it can be [illegible]ed in the patient's computer record. To complicate the problem, much [illegible] in the record become obsolete within 48 hours because of [illegible]es in the patient's condition (except for legal and research purposes). [illegible]conomic reasons it must therefore be transferred into some form of [illegible] storage, leaving the basic and current information available for fast [illegible]

[illegible]so difficulties arising from social and environmental factors. For [illegible] the question of personal privacy — ensuring limited, [illegible] private information.

[illegible]quivalent to the Management Information System is the [illegible]pital Information System (HIS). The purpose of HIS was to "put it all together" and bring about a revolution in hospital operations and management. These visions may still come to pass, but at the moment the general HIS concept has not yet developed into a system which is genuinely workable or economically feasible. The present problems arise from the vast quantity of medical information that must be reduced to standard form and the inability of systems-designers to grasp the diverse and complex operations of a modern hospital or medical centre.

Despite the complex nature of the problem, several hospital information systems have been developed and are operative in the United States. Six of these systems are available for sale or lease. Best-known are the Medical System, operated by General Electric in the New England region for several users, the REACH system, the Lockheed Medical Information System, and a comprehensive hospital package developed by the McDonnell-Douglas

Automation Company. Experience with these systems has shown that a reasonably full range of business and patient care functions costs in the vicinity of $5 to $10 per patient-day.

Within the spectrum of patient care services, there are a number of self-contained applications. These include many of the "special systems" referred to in Chapter I — such as clinical lab systems, patient monitoring-systems and ECG analysis systems. Many of these isolated applications have been implemented on a stand-alone basis, often based on the use of a mini-computer. While these systems are operational, they have, as far as cost-savings are concerned, not lived up to expectations. In many cases, they have been individually programmed for relatively unique situations and hence are not easily adapted, either for linking to a larger system, or for use in another environment. In general, the patient care applications have been slow to develop, even with specially designed and manufactured EDP systems in existence.

3. PATIENT RECORDS

Some of the more general problems facing the automation of patient records have already been outlined. At the national level, it certainly seems desirable to have a system of health records, uniquely identified for each individual, that can be accessed throughout the country, to provide consistent health care and eliminate duplication. However, this goal still seems far away, and to the average hospital director and physician, there are more urgent problems to be solved that could bring faster and more evident benefits.

Mechanization of the patient record has limited value for the actual operation of the health care system unless it is made available to serve various purposes at the point of service. For this reason, it is necessary to distinguish between the mechanization of patient records for off-line record-keeping (medical audit, research) and the type that is organized for direct use in the on-going delivery of health care. Services such as those provided by PAS/MAP and HMRI belong in the former category. This section focuses on the action-oriented uses of the automated patient record, for it is from this area that major benefits from hospital automation will probably originate.

The record of a hospital in-patient is highly active, since it is the ultimate repository and source of data on the patient's condition and prognosis. For hospital use, the patient record should contain three classes of information: patient identification, administrative data, and medical data. Its content can originate from many centres within the hospital. In the reverse direction, data on the record may be required by many different medical personnel for the making of clinical decisions. Thus, rapid and accurate updating of, and retrieval from, the patient record are crucially important to efficient operation. Even if the record is not automated there is a need for location control (to avoid unnecessary delay), and rapid access to patient data.

There are several on-going projects in Canada on medical record automation:

- There is a group practice in Saskatchewan which is centralizing and computerizing its records. Each physician in the clinic will have access to a (desk top) terminal to retrieve information from a patient's file.
- McMaster University is developing a patient record system for its family practice unit.
- Department of National Health and Welfare is planning a computerized health record system for 35,000 [illegible]eople in the Northwest Territories. Data will be stored in an Ottawa-based computer, and made available to district health offices through telecommunication links. The data bank will carry information on individuals, doctors, facilities and social problems.
- The Centre hospitaliér universitaire (CHU) in Sherbrooke, is developing a centralized administrative system for all 14 hospitals in Quebec Administration Region #5, which contains nine counties and 600,000 people. The objective is to develop and test a pilot-system which can then be implemented in all hospitals in the Province of Quebec. The data bank associated with the system will contain on-line critical medical records, historical records, results of lab tests and administrative data. Currently the centre is processing the payroll for 10 hospitals, performing some real-time lab tests and analysis of medical records. The project was started in 1966, with the first major modules due for completion by the end of 1971. The schedule calls for the pilot-project to be completely operational by the end of 1972.

[illegible] LABORATORIES

[illegible] primary motivation for laboratory automation is provided by the doubling [illegible]oads every 3 to 5 years. To hold down the costs of wages and [illegible]laries, and to meet the demand for faster service in the face of the rapid [illegible] it is necessary to use staff and equipment more efficiently. [illegible] estimated that up to 30% of a lab technologist's time is spent [illegible] many of which can be equally well performed by a [illegible]puter. For although automatic test equipment has been installed, the [illegible] reporting methods are basically unchanged from a generation [illegible]

[illegible] laboratory work cycle is as follows:

- Requisition test;
- [illegible]pecimen collection;
- accessioning;
- data acquisition and calculation;
- reporting;
- workload recording;
- analysis of test and patient data.

Computers can, theoretically, be used in every step of this cycle, from the initial ordering of the test by a physician from a nursing station terminal, to the reporting of results back to the ward. However, in order to do this, the laboratory must be linked to the central system, at least for the purposes of requisitioning, reporting, updating the patient chart, and billing. For a stand-alone laboratory system these interfaces are document-based. This is the situation today in most hospitals with computers in their clinical labs.

There are many specially-designed laboratory systems available in the the market-place. These tend to be similar in price and capability, although none of them cover all possible functions. Most are based on the on-line use of a mini-computer to perform the basic functions of accessioning, data acquisition and calculations and printing of test results for distribution back to the originator. These systems are technically sophisticated, capable of reading digital values from peak detectors and digitizing analogue signals from

automated test equipment. Software techniques are also available to correct for instrument drift and noise. However, the largest problems still remain at the interface — sample identification and patient identification are still not perfected.

Owing to differences between installations, customized programming and the small size of the computers involved, laboratory systems today are normally dedicated. This is coming to be recognized as a problem, because it will, to some extent, hinder communications between dedicated lab computers and either central hospital information-systems or other laboratory computers.

Technically, however, this area is fairly well developed. Several laboratory systems in the U.S. are reportedly installed and operating satisfactorily. Among the commercially available systems, the MUMPS system, developed by the Massachussetts General Hospital, and the Berkley Laboratory System are considered to be well on the way to what is basically required. St. Paul's Hospital in Vancouver, is currently using the MUMPS system, and the Alberta University Medical Centre is using the Berkley System.

In Canada, success with automated laboratory systems has been mixed. Several hospitals, such as St. Paul's in Vancouver, Notre Dame in Montreal, the University Medical Centre in Edmonton, the University Hospital in Sherbrooke and the University Hospital in Saskatoon are using laboratory computers and evaluating their effectiveness. Others, such as Hamilton General, Ottawa Civic and Sick Children's Hospital in Toronto, have abandoned their attempts. Overall, it would seem that automated laboratory systems are not quite well enough developed to be cost-effective at this point, although it has been learned that very high-volume laboratories seem to be able to operate more efficiently with them. Some groups have concluded that this volume dependency points to the need for regional laboratories.

5. SCHEDULING

Out-patient scheduling aims to minimize patient waiting time and waiting space, as well as avoiding any waste of the doctor's time. Simulations of the types of queueing problems likely to arise would allow various strategies to be evaluated to cope with the problem. At least one such study has been conducted in a Toronto hospital with the result that some rules were developed. However, as far as can be determined, the recommendations have not been implemented.

Hospital in-patient scheduling is a complex problem. It is similar to job-shop scheduling, in that both the order and the rate of medical procedures can be varied within limits. Complicating it is the continually changing patient's condition making previous schedules inadequate or redundant. Due to this fact, and to the state of the system, an invariant schedule cannot be worked out for the patient at admission time. Accordingly, all schedules must be subject to change by medical staff (*i.e.*, interactive). A proper scheduling system should have as its goal the minimization of the total cost of caring for a patient during a hospital stay without lowering the quality of care. Studies

have demonstrated that it should be feasible in many cases to carry out patient examinations and routine tests (*e.g.*, radiology) as an integral part of the admissions procedure before the patient becomes hospitalized.

While computer-assisted scheduling appears to offer benefits, it is little used in Canada at the present time. Projects for operating room scheduling are known to exist at the Victoria General Hospital in Winnipeg, at the Notre Dame and St. Justin's Hospitals in Montreal and the Saskatchewan Hospital Systems Study Group.

6. COMPUTER-ASSISTED DIAGNOSIS

Several sub-systems for use in specific areas have been developed in various countries, but nothing approaching a general diagnostic capability has yet been achieved. Virtually all the limited diagnostic sub-systems are experimental at this stage.

In Canada, the only area of significant development is that of automated electrocardiogram (ECG) analysis. In 1970, over $300,000 was granted to researchers working on computer-aided ECG interpretation. A number of facilities exist for processing ECG's on a remote basis, using ordinary telephone lines for transmission. Most of these facilities utilize a small computer linked to a large computer for the heavy calculations. There are some 15 research teams in Canada using 5 different systems (4 U.S. and 1 Swedish). Among those institutions developing or using ECG analysis systems for remote use are:

- University of Montreal
- Laval Hospital (Quebec City)
- Quebec Institute of Cardiology
- Sherbrooke Regional Health Project
- Dalhousie University
- University Hospital, Saskatoon
- Queens University

A start is being made using mini-computers on EEG (electroencephalograph) interpretation. The Clarke Institute in Toronto, the Montreal Neurological Hospital and Notre Dame Hospital in Montreal, are known to be involved in this area. Special diagnostic aids continue to be developed in the United States. For example, spirometric examinations (for lung function) have been practically automated, with the computer even instructing the subject in breathing procedures. Of course, fitting curves to respiratory data is well-suited to the computer's capabilities and can save substantial technician time.

7. OTHER APPLICATIONS

There are a number of additional areas in which the use of computer techniques is not well developed or not widely beneficial at this point. These applications cover a broad span of functions, including multiphasic screening, physiological monitoring, radiology, food and dietary services, pharmacy, computer-assisted training and radiation treatment calculations.

Multiphasic screening is the identification of a previously unrecognized disease or defect by the application of tests, examinations, and other procedures that can be applied rapidly and with personnel less skilled than physicians. Using automated techniques, screening was started by the Kaiser Permanente Group in California about 10 years ago and has since spread to over 150 centres in the United States.

Multiphasic screening is being tried at St. Paul's Hospital in Vancouver, and by Medical Data Services, a private laboratory in Toronto. At this point, the service appears to be more costly than the traditional doctor's examination. The main reason is that a standard set of lab tests is performed involving substantial fixed cost, as compared to the selective testing approach of a physician. Nevertheless, the Toronto-based service is well utilized and, in general, operators are convinced that further refinements in the technique will make the service economically feasible.

In the area of physiological monitoring, there has been much development in the U.S., largely generated by the manned space mission programs. Lockheed Aircraft, Massachussetts General Hospital and the Mayo Clinic are the leaders in the field. In Canada, experimental work is going on at the Hospital for Sick Children and the Toronto General Hospital in their intensive care and coronary care units. Toronto General is also developing a blood-flow monitoring system based on the use of a small computer that forms part of an automated cerebro-vascular unit.

At the present stage of development, applications in the functional areas of radiology, food services and pharmacy have marginal cost effectiveness, and can be justified only on the basis of very high volume and shared use of a central computer. However, their feasibility has been established in the United States. By using automated menu planning, for example, one user claims a savings of 24% on food costs. Like lab data, radiology data lend themselves to computer processing, since both input and output are numeric and the calculations follow well-established procedures. The University of Saskatchewan has a project underway to develop a satellite pharmacy drug distribution system. This work should assist in the evaluation of the feasibility of this application.

While computer-aided learning (CAL) is not directly concerned with the delivery of health care, it has significant potential value for medical and para-medical personnel. At present, the University of Alberta uses CAL for training doctors in cardiology and patient monitoring. Radium dosage calculations for cancer patients are being performed on computer by the B.C. Cancer Institute and Princess Margaret Hospital in Toronto.

8. MEDICAL AUDIT SERVICES

Two specialized organizations use computers to provide medical audit services. The larger of these is Professional Activity Study/Medical Audit Program (PAS/MAP) which has its computing facilities in Ann Arbor, Michigan. As

shown in Table 5, PAS/MAP currently serves about 244 Canadian hospitals. The Hospital Medical Records Institute (HMRI), is a non-profit organization set up by the Ontario Hospital Association and based in Toronto. HMRI services about 107 hospitals in Canada — about 15%. On input forms, codes are used for patient and doctor identification, as well as for diagnosis and procedures.

Both organizations receive their input as mailed forms and employ batch-processing techniques to compile and report on the data.

The PAS/MAP system automatically compiles a hospital's routine statistics and provides cross-indexed printings of case abstracts which are useful as disease, operation and physician indices within the hospital. Special statistical compilations are available on a special request basis. The cost of the PAS/MAP service is 40 cents per admission. Hospitals using the service have found that their medical record department costs are decreased because of the resultant labour savings. In addition, medical records are better maintained and can be more reliably used for clinical research.

An added benefit of the PAS/MAP system is its resource data base of over 10 million hospitalizations, which has been built up on magnetic tapes.

HMRI uses the computer facilities of the Ontario Hospital Services Commission. Its services are essentially similar to those of PAS/MAP, differing somewhat in data requirements and flexibility. The cost is 42 cents per admission. This program does not restrict participating hospitals to any one system of coding. Consultation is provided to assist hospitals in determining their needs. As an indication of the data contents, the following items may be included in HMRI records:

- Dates of entry and release, with computed length-of-stay;
- Death Analysis (includes still-born);
- Accommodation — standard, private;
- Admission Status — elective, urgent, emergent;
  Age by hours, days, weeks, months, years;
- Sex;
  ntensive care;
  entity by code number of:
  nding physician (one or more)
  ltant
  sthetist;
- Identity of Hospital Service or Services involved in care of case:
  Procedural
  Consultant
  Resident;
- Investigations recorded in chart:
  Haemoglobin or haematocrit
  Chest x-ray (routine)
  Weight of patient
  Haematology
  E.C.G.
  Radioisotopes
  Blood-pressure
  Serology
  Biochemistry
  Ordered x-ray studies
  Microbiology
  Others elected by the hospitals;
- Complications of care:
  Medical
  Surgical
  Anaesthesia.

TH INSURANCE PLANS

The bulk of the work of provincial health and hospital insurance commissions involves the data collection and processing of insurance policies, premiums

and claims for payment. Most provinces use computers for the processing of transactions on a batch basis, receive their input by mail, teletype or by hand.

In the course of this routine processing, the commissions build up magnetic tape files for each family or member belonging to the plan. Due to rising costs, and the necessity of raising premiums, the insurance commissions have started to use the computer to monitor the types of medical care delivered and the volume of practice. Analysis of the accumulated data will lead to calculation of the cost-benefit performance of the provincial health systems. To the extent that the records include data on diagnosis and treatment, they can be used for research into epidemiology and patterns of health care utilization.

For example, in Manitoba, provincial health care records are used to ensure that applications for drivers' licenses do not misrepresent the state of health of the applicants. In theory, it is possible to envisage further linkages between medical records and other files for similar purposes. Files are kept on individual physicians to guard against malpractice and data are analyzed for billing and treatment procedures.

10. MEDICAL DATA BANKS

Provincial public health departments have the responsibility of monitoring infectious and communicable diseases and other conditions that could threaten the health and well-being of the people.

One automated data bank of medically-related information is maintained by the Medical Information Bureau in Boston, Massachusetts. This organization is used by all North American Insurance companies as a means of listing the names of rejected insurance applicants.

The provinces of B.C., Ontario and Quebec are participating in a project to develop a general registry for Pap smears and the incidence of certain forms of cancer. In Saskatchewan, the Cancer Commission has established a file of cancer patient records, including personal, diagnostic, treatment and follow-up data on 50,000 patients. Also in that province, the Federal Department of National Health and Welfare is supporing an automated immunization program by regional health services.

11. RESOURCE PLANNING AND MANAGEMENT

Use of the computer in operation research studies can assist in the planning and management of health care facilities. The techniques are not widespread, but there are some notable examples of work in the simulation of health care delivery in the Vancouver area for the purpose of making general policy and assigning resources. Making use of population and morbidity projections, the model forecasts the degree of health care available in the region if a given amount of resources were applied. The model is intended to help in policy-making and does not attempt to simulate the detailed operation of the health care system.

The Ontario Hospital Services Commission has an operations research team, that has developed models of ward care and ward monitoring as well as Ontario Ambulance Services Information Service (OASIS). The group also developed the "Relative Stay Index" for comparing the performance of various Ontario hospitals regarding the length of time required to treat various diseases.

12. PROBLEM AREAS AFFECTING AUTOMATION

It can be inferred from the current status of medical automation in Canada that the picture is highly fragmented. In some areas there is little work being done, in others, many similar types of experimental applications are taking place across the country (*e.g.*, ECG interpretation). Since the potential benefits to be obtained from the use of computers in medicine are far from being fully realized, it is worthwhile to mention some of the problems that appear to be retarding the rational development of automation in the medical field. These are listed in no particular sequence, and, as can be seen in many cases, problems overlap. Their inclusion is useful as a means of illuminating the types and extent of difficulties likely to arise when attempting to set forth any policies for the increased use of computers and communication technology in medicine. Indeed, the nature of these complexities is such that simple solutions are not apparent:

- High cost of medical system development (particularly software);
- dearth of R&D money for hospital management methods;
- lack of comprehensive understanding of the management process in health care organizations;
- lack of enthusiasm by physicians and hospital administrators for the use of computers, perhaps due to lack of understanding;
- lack of competitive pressure on hospitals to improve performance. Insufficient supplementary incentive for better performance.
- lack of informed customer demand for better methods;
- as hospitals are often run by committees, it is often difficult to obtain decisions;
- communication difficulties between physicians, administrators and technical people, due to differences in terminology goals, ways of thinking;
- shortage of persons trained in systems who are also familiar with medical/hospital conditions and problems;
- inherent complexities in mechanization of medical records;
- no "universal" system of patient identification;
- no effective spokesman/co-ordinator/planner for medical technology;
- high cost of ensuring reliability and continuity for health care computer applications.(i.e., need for duplication);
- difficulty of making computers as "transparent" as possible to users;
- high cost of large-volume, direct-access storage;
- difficulty in generalizing on continuous pattern of procedures for use by several hospitals, especially in regard to patient-care applications;
- lack of standardization in methods and procedures.

Chapter III
Future Trends

Health care applications of computer/communications technology have not yet been developed to the point where they can function in a demonstrably economical fashion. Cost-effectiveness can be influenced by many factors, such as volume of data processed, system acceptance and suitability of computer facilities or service. Yet, except for the routine business applications, which are not unique to the health field, computer uses in health care are not very attractive propositions at the present time.

The main underlying cause for this slow rate of progress is the inherent, complex nature of medical computer applications. The problem is further exacerbated by the shortage of people with the right combination of skills, and by the problems of communication between systems people, hospital administrators and medical personnel.

The gap between the potential for the use of technology in health care management and its present limited usage is becoming increasingly evident to the health care planners, administrators and policy-makers. This awareness, combined with the forecasts of market surveys and the consensus of health care professionals, points to an increased pace of development of medical [illegible]stems in the future. Effort will probably concentrate more on the [illegible]elopment of software, while also using the hardware technology which is [illegible]r will become, available.

[illegible]ontinuing expansion of the technology, coupled with the [illegible]cessity to use it, is creating pressure for more fundamental [illegible] in the structure of organizations providing health care. A tendency [illegible] voluntary co-operation of hospitals in geographical proximity has [illegible]n observed. This trend toward regionalization is expected to [illegible]where administrative, as well as some health care functions, are [illegible] means of providing the required volume to justify computer [illegible]ences which should lead to increased automation can also be [illegible]mple, the gradual influx of younger doctors and [illegible]o are likely to be more receptive to changes in [illegible]ll as the pressure on hospital managements to keep up [illegible]f their counterparts in other regions and countries. A [illegible]will be the role of the educational process in preparing me[illegible]medical personnel to use medical technology and data.

Any com[illegible] computer system must incorporate the policies, goals, objectives[illegible], as well as the ways and means of its parent (or user) organi[illegible]queness and style of any given business or institution is so intim[illegible] structuring the total system that the two are insepar[illegible] to one is to refer to the other. Thus, an information system s[illegible]number of hospitals and other health care facilities in a specific [illegible]necessitate a common philosophy and working arrang[illegible]

The ob[illegible]ation, day-to-day utilization and effects of an information system [illegible]evaluated prior to its actual acquisition and implementation. For this [illegible] would be futile for this study to recommend any specific

applications or actions involving the use of computer/communications technology for the health care field. Most of the urgent needs have already been identified by other studies and reports concerned with the quality, types and cost of health care services. It is up to the individual hospitals, commissions and regional associations to translate these general needs into specific requirements for their own operations.

Clearly, the computer is a sufficiently flexible tool to have considerable application in the field of medical services. The concrete questions of *what* applications, *when* they are needed and *how* to develop and use them cannot be answered in general terms. In substance, this is a job which can only be performed by those who are directly involved in the health care business.

1. TECHNOLOGY

The equipment required to enter, store, process, retrieve, communicate and display medical data is basically similar to that for any other area. Since much equipment is already developed and available, hardware capability is not a stumbling block to the increased penetration of the computer into the health care industry. Hardware costs are certainly not small, but they are declining steadily, and therefore cannot be regarded as a major source of delay. The exception to this statement is, perhaps, in the storage of high-volume patient records and history on directly-accessible media. Again, the problems of coding, structuring and filtering this data will probably present more pertinent problems than the cost per "bit" of the storage used.

An important problem still lies in the application of the computer to the management of everyday operational procedures in health care centres. Their solution depends upon the design of equipment configurations and operational programs which can perform functions that are more efficiently handled by machines than by health care personnel and can also interact smoothly with the staff. Reliability and continuity of service are of paramount importance in medical systems, where failure or loss of service could lead to injury or death. This requirement usually implies fully-duplexed computer facilities and fully debugged and recoverable programs. Since user-acceptance will depend on reliability, long testing and shake-down periods will be required before any system can be made operative.

Health services cover a wide range of computer applications, from real-time control of lab instruments, to numerical computing for statistical analysis, to large data base management, to high-volume transaction processing. Under these conditions, it is impossible at this stage, to define a single configuration of computers or set of telecommunications linkages which would simultaneously and efficiently fulfil the variety of needs of all parts of the health services sector.

The important problems to be solved, and the gains which can be made, are in the application of technology to health care at the individual institution at local or regional level. These are many and diverse, ranging from administrative transaction processing within a hospital, to local computer sharing, to regional or provincial facilities planning. A "national network" may

ultimately coalesce due to the merging of many independent systems and networks by means of telecommunication links.

Considering our highly-mobile society, there will be an increasing need for the linkage of patient records between provinces or regions. A fully-operational Medical Information Retrieval System would undoubtedly be the answer. However, the return on such an investment would be highly questionable at present, compared to other projects.

Statistics are already being collected by Statistics Canada and National Health and Welfare from patient discharge reports and annual hospital returns. In any event, statistics can be adequately collected and summarized at intervals and do not require instantaneous transmission.

Computer-assisted diagnosis may someday be of great benefit, but that day is still far in the future. Most experts do not envisage any kind of generalized computer diagnostic capability before 1985. Specialized diagnostic aids, such as ECG interpretation, can now be satisfactorily distributed (*i.e.* made available) through the use of dial-up telephone lines.

Finally there is the issue of patient-record linkages and portability. This leads to the requirement for standardization of content and format of patient medical data and for compatability of data interconnections. This is an important matter, since it concerns the extent to which patients are treated both intra- and interregionally. No data of sufficient significance have been found to make it possible to evaluate the present extent of this kind of activity. Its impact is therefore difficult to assess.

2. HOSPITAL INFORMATION SYSTEMS

With the exception of administrative applications, the experience of the past few years has shown that piecemeal patient care applications of computers are seldom cost-effective. Since a hospital operates as a system, albeit with many separate clinical units, there is a great deal of intercommunication between the various departments and an over-lapping of functions. From the point of view of efficiency, the interactions between service centres make it difficult to design viable stand-alone or independent sub-systems.

In the midst of all this activity is the patient — the centre of a wide range of differing procedures. If a hospital information system is regarded as a "model" or "image" of the on-going hospital procedure, then the patient record is, similarly, the centre of the computer-based system.

Continuing with this analogy, just as the physician forms the main link between the patient and the hospital services, so the medical order in an information system forms the link between the patient record and the various sub-systems associated with hospital service centres. This concept of the central role of the physician's order is the key principle of the Lockheed Hospital Information System and the REACH system, two of the first "general" medical systems now commercially available in the United States.

To be capable of handling most medical orders, a computer system must accept the orders from nursing stations, for example, and be able to transmit them to the complete group of service centres which can then act upon them. However, in so doing, the system should go much further than simply communicating the orders. The information, plus additional data on available resources, should enable the computer to schedule laboratory tests, x-rays and operations. The results of actions initiated by such orders can be fed back into the system and used to update the patients' charts. Forgotten orders can be reported on an exception basis for follow-up action. The particular service performed can be itemized and posted to the patient's account. Thus it can be seen that one of the major roles of the hospital information system is to tie together all the sub-systems, whether they are automated or not.

The necessary computer power could be obtained in several ways:

- In-house main computer
- Large-scale computer shared by several hospitals
- Commercial computer service

In general, service bureaux may not be acceptable to most hospital managements because of fear of loss of control and possible loss of service. However, a commercial computer service, dedicated to the offering of hospital applications, may be able to overcome these objections. In essence, it is the equivalent of the computer shared by a collective group of hospitals, except that the economic risks and ownership belong to an entrepreneur.

Large-scale in-house computers will probably be restricted to very large hospitals, especially those connected with medical schools and those doing research and development into computer applications. Small computers will continue to be used in a number of specialized functions, such as control of laboratory instruments and patient monitoring. These may require communication with the main or central computer in order to be integrated into the overall system.

Customization of programs and procedures to suit the requirements of different hospitals will be possible. First, a number of different "packaged" systems are likely to be available. Choosing among these will allow the prospective user to exercise basic options. The available system will undoubtedly be modularly constructed to allow modifications to portions of the system without destroying its operational integrity. As the information systems will support the hospital in carrying out its functions, they will have to be adapted to existed practices to minimize disruptions of personnel and to ensure acceptance.

3. COMPUTER-ASSISTED DIAGNOSIS

Some experts in the field of medical systems believe that the possibility of assisting physicians in diagnosing disease and abnormal conditions is potentially the most rewarding of computer applications in health care. Others question the goals and viability of the whole concept, concluding that there is little scope for the computer in general diagnosis. However, there is one point

on which general agreement seems to have been reached, and that is that there is little chance of any computerized diagnostic system of any sizeable dimensions before 1985-2000. Too little is understood about the mental processes of a doctor as he analyzes symptoms and tests results, in order to reach a diagnostic conclusion. There is art as well as science involved in the diagnostic process and much work remains to be done in understanding and documenting the detailed methodology of the current practice of clinical diagnosis. Current computer-aided diagnostic techniques are based on the use of Bayesian statistical inference and are probably inadequate, considering the complexity of the problems involved.

In special cases, where the main nature of a given condition has been isolated, computer systems have established a measure of success. For example, an experimental programme at the University of Missouri for the diagnosis of rheumatic heart disease using chest x-rays achieved overall test accuracy of 73% compared to 62% for a control group of radiologists.

There is no doubt that specialized diagnostic systems can, theoretically, obtain better definition and greater precision of measurement and analysis of quantitative data for diagnostic processes. By augmenting the pattern recognition and inferential capability of the physician, such systems can be most useful. Benefits will arise out of improved accuracy and speed of diagnosis, which, in turn, will lead to more satisfactory methods of treatment.

APPENDICES TO PART B3

CANADIAN HEALTH CARE DELIVERY CENTRES VISITED

Royal Jubilee Hospital	Victoria
St. Joseph's Hospital	Vancouver
Vancouver General Hospital	Vancouver
British Columbia Cancer Institute	Vancouver
Department of Pathology, UBC	Vancouver
St. Paul's Hospital	Vancouver
C U & C Health Service	Vancouver
University Medical Center Hospital	Edmonton
Glenrose Hospital	Edmonton
Foothills Provincial Hospital	Calgary
Regina General Hospital	Regina
Regina Grey Nuns' Hospital	Regina
Medical Arts Clinic	Regina
Manitoba Rehabilitation Centre	Winnipeg
Victoria General Hospital	Winnipeg
Manitoba Hospital Commission	Winnipeg
Hotel Dieu de St. Josephs	Windsor
St. Joseph's Hospital	Chatham
Public General Hospital	Chatham
Victoria Hospital	London
Southwestern Ontario Computer Center	London
St. Thomas-Elgin Hospital	St. Thomas
Greater Niagara Falls General Hospital	Niagara Falls
Hamilton Civic Hospital	Hamilton
McMaster Medical Centre	Hamilton
Toronto Western Hospital	Toronto
Clarke Institute of Psychiatry	Toronto
Sunnybrook Hospital	Toronto
Ontario Hospital Association	Toronto
Hospital Medical Records Institute	Toronto
Hospital for Sick Children	Toronto
The University Teaching Hospitals Association	Toronto
Princess Margaret Hospital	Toronto
The Ottawa Civic Hospital	Ottawa
Information Sciences Institute	Ottawa
The Royal Victoria Hospital	Montreal
Notre Dame Hospital	Montreal
Joint Hospital Computing Centre	Montreal
Sous-comité d'informatique medicals	Montreal
Laval University Medical Centre	Quebec City
St. Michel Archange Hospital	Quebec City
Victoria Public Hospital	Fredericton
Department of Health (Provincial)	Fredericton
Chaleur General Hospital	Bathurst
Moncton General Hospital	Moncton
The Riverside Hospital of Ottawa	Ottawa
Canadian Hospital Association National Assembly	Montreal
Fifth Annual Hospital Systems Research Symposium	Toronto
Third Annual Hospital Systems Institute	Saskatoon

Ontario Hospital Services Commission	Toronto
Department of National Health and Welfare	Ottawa
Statistics Canada	Ottawa
Centre hospitalier universitaire de l'université de Sherbrooke	Sherbrooke

APPENDIX 2

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APPENDIX 3

ACKNOWLEDGEMENTS

Special thanks are extended to the following, who were among those who gave so generously of their time, knowledge and ideas to this study:

Mr. J. Allen
Dr. J.C. Allison
Mr. H.M. Anderson
Mr. H. Annand
Mr. F. Babbi
Mr. J.W. Borthwick
Dr. E.F. Bourassa
Dr. A. Bradford
Dr. W.R. Bruce
Mr. G. Cardiff
Mr. J. Carter
Mr. M.I. Chase
Miss I. Colvin
Dr. L. Cousineau
Miss J. Couture
Mr. R.V. Criddle
Dr. J.R. Cunningham
Mr. T.A. Cunnings
Dr. W.F.O. Daechsel
Mr. J.B. Davis
Mr. H.G. Dillon
Mr. T.L. Doyle
Dr. G.B. Duncan
Mr. E.C. Emery
Mr. F. Endrea
Mr. W.T. Engelstad
MR. W. Essan
Dr. D. Fenna
Mr. N.D. Gary
Mr. D. Gemino
Dr. J. Gibson
Mr. R. Graham
Mr. R. Grant
Mr. G. Haley
Mr. A.R. Haskall
Mr. P. Hayden
Mr. D. Hayes
Mr. E. Hosein
Mr. F.W. Hunnisett
Dr. W. James
Dr. H.C. Johns
Miss F. Jones
Mr. W.A. Kilpatrick
Mr. G. Kourie
Mr. T. Kutcha
Dr. R.A. Lambert
Dr. M. Lavallee
Dr. D. Ledoux
Dr. A. Lizotte
Dr. M.D. Louth
Sister Lowens
Mr. J.B. MacAulay
Mr. A.D. Mackenzie
Dr. I. Maclennan
Mr. D.C. MacNaught
Dr. R. Makepeace
Dr. Y. Mauger
Mr. J.K. McCafferty
Mr. D.C. McCalmont
Dr. F. McKerrachen
Mr. G. Morgan
Dr. J.K. Morrison
Mr. J. Mortant
Dr. C. Mueller
Dr. H. Nichol
Dr. W. Noonan
Dr. B. Pearce
Mr. R.J. Pearce
Mr. E. Pickering
Mr. J. Roberts
Mr. C.M. Robertson
Dr. V. Rosenfelt
Dr. A. Rotenbert
Mr. D. Ruptash
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Mr. R. Taylor
Dr. K. R. Thorton
Mr. J. Wall
Mr. K. R. Weaver
Miss D. Wiley
Mr. B. E. Wilfred
Dr. C.H.A. Wilmont
Dr. D.R. Wilson
Mr. C.A. Wirsig
Mr. H. W. Wishermann
Dr. G. Wright
Mr. M.D. Zann

APPENDIX 4

DESCRIPTION OF UNIVERSITY OF SHERBROOKE HOSPITAL NETWORK

1. The Centre hospitalier universitaire (CHU) de l'université de Sherbrooke is developing a medical complex using all of the existing hospitals (14) in Quebec Administrative Region #5, grouping 9 counties and 600,000 people.

The aim is an operational and functional merger of the services through common computer-based data banks and management systems. The 14 hospitals will keep their autonomy, but service to clients will be ''transparent'' from any hospital. Unnecessary duplication of specializations will be avoided.

This operation is a pilot project by the Department of Social Affairs which funds the CHU through a non-profit organization: CISE (Centre d'informatique de la santé pour l'Estrie).

The merger was made possible by the common set of standards for management set by government in all the hospitals.

The organization for services will be three levels of care:

- Primary: Small hospitals as point of entry, and local health centres.
- Secondary: Medium-sized hospitals as specialization centres.
- Tertiary: CHU — Highly-specialized centre and research institute.

Data bank will include:

- Socio-economic data on citizens.
- Critical medical records (on-line).
- Historical medical records.
- Lab tests.
- Administrative data.

Present state of system:

- Payroll of 10 hospitals.
- Same real-time lab tests (no electro-cardiography yet).
- Functional analysis of medical records.

Work is being done on:

- Specifications of common set of programmes and standards on medical records.
- Data Bank creation and interface software.

Staff (CISE) — 30 people: Administration
Doctors
EDP specialists

Research Group on Medical Records: 40 people

Hardware — Administration: Univac 1106 Labo. DNA 2703 linked to Raytheon 703

Software — Common coding language: SNOP
ID SIN + alphanumeric codes.

2.
- Project under way since beginning of 1966, when staff consisted of six people.

- Budget of $1.5 million.
- At present, most of the 70 members of staff are working on development.
- Development is done at the CHU.
- Processing will be done at Hôtel-Dieu de Sherbrooke.
- Co-operation underway with McMaster University;
- National Institute of Health, U.S.
- System is based on computer/communications. Volume of traffic will not be large for pilot-project.

lication will contribute to making more medical services available to people without disproportionate rise in costs.

benefit has not yet been established but cost/effectiveness is already ve results.

by Department of Social Affairs (Quebec) now. *Centre* *ue* is expected to be financially autonomous in 16 months.

still limited but improved services should increase

ystem is designed to be adapted to all Quebec hospitals. Access methods include protection of personal data.

8. First modules will be operational by the end of 1971. Pilot-project will be completed by the end of 1972. After evaluation, it will be extended throughout Quebec

9. Management of project is under doctors' control. Co-operation of the hospital management keeps system close to reality.

APPENDIX 5

THE CASTONGUAY — NEPVEU COMMISSION

RECOMMENDATIONS ON COMPUTERS AND HEALTH

That an integrated electronic data processing system be established in Quebec, based on the following principles:

- The establishment by the Quebec government of a long term development programme;
- An exact definition of the role electronic data processing should play in the entire medicare distribution system;
- Recognition of the importance of the Regional Health Boards[1] in collaboration with the University Hospital Centres[2] and universities in the creation of regional data processing centres;
- The participation of those responsible for the organization and distribution of medicare in the setting-up of the system.
- The establishment of individual medical files for the identification of individuals and families.
- The exact definition in precise and rigorous terminology of the problems submitted to the Medicare Programme.

[1] ORS — Office régionale de la sante

[2] CHU — Centres hospitaliers universitaires

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Machines and computers should become a functional part in a life-oriented social system and not a cancer which begins to play havoc and eventually kills the system.

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